ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXVI, No. 21. CHICAGO, SATURDAY, MAY 22, 1915. ISSUED WEEKLY

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET
CHICAGO

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One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back one month, each.. .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879

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THE AUSTIN DAM.

A new dam and power plant have been built at Austin, Tex., upon the site of the old structures which were built in 1893 and washed away by the flood of 1900. The loss of the old dam seems to have been due to defective construction, although many engineers have expressed the opinion that no dependable dam could be built at that location. The work of the engineers who have completed the present project indicates, however, that the present dam will be safe from the danger which finally resulted in the destruction of the old one and it may be expected to be a permanent structure.

There are many points of interest in connection with this work, which is described on other pages of this issue, but the interest centers more about the civil engineering features of the project than the electrical engineering. The method of utilizing the remaining portion of the original dam and at the same time keeping the maximum water level to the old value while increasing the normal water level is ingenious. The two portions of the dam will be at different heights and will also have crest gates of different heights.

The greatest problem in connection with this dam was undoubtedly the construction of a suitable foundation. The region is underlaid with limestone rock and this is full of seams, crevices, soft spots and cavities. Nevertheless the engineers have succeeded in making one of the most water-tight dams ever constructed. This was accomplished by forcing grout into all of the openings which came to light and running the concrete work down to solid foundations.

The dam itself has many interesting points, of which but a few can be mentioned here. Expansion joints have been provided and their construction has been found entirely satisfactory. The structure has already been subjected to temperatures varying from 32 degrees to 90 degrees Fahrenheit and the relative motion of the parts has been very noticeable. The construction of the crest gates already mentioned and the provision for their automatic operation is another interesting point and the successful operation of these crest gates has already been demonstrated by a period of flood. One of the innovations introduced in this dam is in placing the operating mechanism for the sluice gates on the up-stream face of the dam instead of in its interior, as is customary. These gates are operated from cylinders which are supplied

with oil under pressure. These cylinders are entirely submerged in water so as to be inaccessible for inspection and repairs. Nevertheless the engineers do not anticipate any trouble and this method of construction results in considerable saving in first cost. These gates are operated so infrequently that wear, of course, does not come into question. It is stated that in 50 years the wear on the bearing surfaces will be no greater than that which occurs in a Corliss engine operating for two hours. The pistons are made of bronze so as to avoid any trouble from corrosion, and metallic packing is used. Indicators are provided in order to show from the inside of the dam what is the position of the gate. These indicators consist of weights attached to a copper wire cable which is connected to the gate and passes through a pipe to the inside of the dam, a stuffing box being provided to prevent leakage.

Of the electrical features of this project little need be said, aside from the descriptions given in the article. Attention may, perhaps, be called to the fact that the turbines are mounted in a cylindrical casing of reinforced concrete, a method of construction not usually employed for units of this size.

The successful completion of this work is a notable event in the hydroelectrical development of the country and great credit is due to the engineers who have carried it to completion.

SELLING STOCK AT PAR.

The decision of the Public Utilities Commission of Maine in the case of the Black Stream Electric Company involves a point which is deserving of mention. The company is newly organized and asked permission to issue its capital stock for less than the par value. The Commission refused to authorize this and took occasion in its opinion, an extract from which will be found on page 955, to call attention to some of the objections to such a procedure.

Stockholders are simply partners in the ownership of a corporation and in one sense of the word the face value of the stock which is issued does not mean much. We all know that a great deal of stock is issued without any corresponding investment, but nevertheless it is customary to put a par value upon the face of the certificates. The proposal has frequently been made to omit any such statement of par value and to let shares of stock merely represent a proportional interest in the ownership and management of a corporation.

Where a par value is given it is certainly reasonable to require that it should represent the payment of an equivalent into the treasury of the company. The only object in giving stock a face value different from that which has actually been paid for it is to mislead those unacquainted with the actual circumstances either at present or at some future time. Investors are sometimes persuaded to invest by the bait of a greater par value than the actual investment made, but, of course, any future dividends must depend upon the money-making ability of the business and is not in any way dependent upon the face value of the securities issued. As the Commission pointed out, however, temporary increases in the market value of stocks thus issued are apt to mislead those not familiar with the details of the business into a belief that there is a permanent value back of the stock equal to its par value.

REFINEMENTS OF TURBO-ELECTRIC PROPULSION.

Interest in various electrical applications is so great at present that a few additional points in relation to turbo-electric propulsion may be profitably considered, supplementing our editorial on that subject two weeks ago.

In battleship service the ability to manoeuver a vessel is of such importance that the electric drive would probably be justified on this basis alone, so great is its superiority over other methods. Instead of large and heavy throttle valves to open and close, there are light, easily handled oil switches, and a speed controller that can be manipulated by a single finger. Even if one turbine breaks down, a ship can be run in a normal manner except as to maximum speed. With other methods of propulsion the lack of symmetry resulting from turbine or engine failure becomes very serious. A twin-screw ship operating with one engine or turbine could reach port in safety, but would be of little use in a modern naval battle; while an electrically driven vessel would run just as well with one turbine in use as with two, barring a sacrifice in maximum speed of perhaps 7 or 9 knots.

With mechanical propulsion the failure of one set of auxiliaries may practically shut down the corresponding engine or turbine plant. In a paper on this subject abstracted in the *Journal of the American Society of Naval Engineers* for February, Lieut. S. M. Robinson, United States Navy, points out that even the cross-connecting of main air and circulating pumps does not always prove a satisfactory means of maintaining service in an engine room. Said the author: "I have seen a battleship forced to stop because the forced-lubrication pumps in the starboard engine room broke down. If the ship had gone ahead with the port turbines, the starboard turbines would have revolved and burned out the bearings; with electric drive it would be a simple matter to shift to the other engine room and make repairs without stopping."

Again, the importance of operating a turbine in the same direction all the time cannot be over-estimated in weighing the advantages of the electric drive. It is believed by operating engineers that the greater amount of blading trouble that ships have had is nearly always due to the distortion which occurs when backing. Sir Charles Parsons estimates the losses due to friction and windage of a backing turbine installation to be 0.5 per cent—a sacrifice not required with the electric drive.

IDEALS OF PUBLIC SERVICE.

That public-utility officials and employees are as a whole striving to give the best possible service to the communities which they serve is well known throughout the electrical industry, but it is not so much appreciated by the public and by its authorized representatives as is desirable. It has been our privilege to attend a vast number of conventions, meetings and conferences of electrical men during the past two decades, and it is notable that throughout nearly all these proceedings there has run a strain of idealism which deserves recognition. The tone of discussion constantly has been in harmony with the welfare of the consuming public, and the great problem always before the house has been how to render the best possible service for the revenue received.

It is time that the public should realize that when a group or a convention of electrical men assemble, the proceedings most emphatically are not keyed to a policy of combination for purely selfish aims. There is very little star-chamber work in the industry today. Publicity is welcomed as it never used to be, and in the more efficient use of this policy lies an opportunity for future advancement that is still to be grasped. Let the public realize that electrical conventions are assembled for other purposes than the raising of rates, paring down of service, and stiffening of requirements to be met by the consumer!

Already a good start has been made in this direction at several central-station and contractors' conventions where some one with a clear head and reasonable powers of expression has been assigned to answer the inquiries of newspaper men as to the speakers and discussions.

The public easily gets the idea in these days of centralization that men in different trades are constantly seeking new methods of cheapening the service rendered—of giving the people less for their money than formerly. Nothing could be further from the truth in the electrical industry. Its representatives in convention assembled are certainly out to make money, but not at the sacrifice of the consumer. Witness the reductions in the maximum net price per kilowatt-hour in recent years made possible by commercial development in central-station fields, by exhaustive investigations of operating economy, and particularly by the installation of high-powered generating units and tungsten lamps. We know well enough inside the industry how much more electrical service a dollar buys today than five, ten and fifteen years ago, and we also know that at our conventions and conferences there is no talk about curtailing service, skimping on the quality of lamps, letting the distribution system go to pot, or of increasing the guarantees and burdens of the consumer. No, everything is in the other direction and all that is asked is a reasonable return upon the capital investment.

The policy of the open door is sure to reap its reward in our great and growing industry if we keep it open and not merely unlocked.

MEDALS FOR EDISON.

Everyone familiar with the work of Mr. Thomas A. Edison in developing the applications of electricity (and who is not?) will be pleased to know that recognition of his genius is being made this month from two sources, each taking the form of the award of a medal.

One of these has already been bestowed by the Civic Forum "for distinguished public service," the presentation ceremonies being participated in by some of the most prominent men in the country.

The other medal was presented this week by the Franklin Institute "for signal and eminent service in science." It is known as the Franklin medal and was established through the munificence of Mr. Samuel Insull of Chicago. This medal is awarded in 1915 for the first time and there are two recipients. The second recipient is Prof. H. Kamerlingh Onnes, of Leiden, Holland, whose researches, while not so well known in the electrical field, have in the realm of liquefaction of gases been epoch-making. The most notable of these was the liquefaction of helium, the most permanent of all the gases. This feat made possible the investigation of the properties of materials at temperatures close to the absolute zero. We have had occasion to refer from time to time in these columns to the researches of Professor Onnes, particularly with reference to the electrical resistance of metals under these conditions. At temperatures close to the absolute zero the resistance of the pure metals appears to become infinitesimal.

The achievements of Mr. Edison hardly need recapitulation to electrical readers, or for that matter, to the public in general. Those inventions which have come into popular use, such as the carbon telephone transmitter, the incandescent lamp and the phonograph, are known to all. There are hundreds of other inventions, however, which have been applied in technical ways, unrealized by the layman, and many others which have not received any practical application at all. Mr. Edison has been the most prolific American inventor and his work has had educational value as well as contributing to the comfort and progress of mankind. It is stated that his inventions have given rise to industries employing nearly a million men and it is, of course, realized that the modern system of electrical distribution as well as the means for transforming electrical energy into light is due to him. As an experimenter he stands in the forefront, and the experimental method is the principal characteristic which distinguishes the modern world from the civilization of antiquity.

While the personal qualities which Mr. Edison has brought to his work have undoubtedly had much to do with his successful achievements, it should be remembered that one of his most notable attributes is his capacity for work. Only by marvelous perseverance and concentration of effort has it been possible to work out the almost infinite amount of detail whose successful accomplishment distinguishes the practical inventor from the idealist and dreamer.

Frank M. Tait Honored.

Frank M. Tait, president of the Dayton Power and Light Company, of Dayton, O., received a splendid "send-off" on the evening of May 12, when over 200 persons, including leading Dayton citizens and prominent electrical men from all over the country, attended a dinner in his honor, on the occasion of his departure to take up his work in New York in connection with the Brady estate. With D. L. Gaskill, secretary of the Ohio Electric Light Association, acting as toastmaster, the following prominent men spoke to the gathering: Former Governor James M. Cox, of Ohio; President E. A. Deeds, of the Dayton Engineering Laboratories Company; Holton H. Scott, of New York, president of the National Electric Light Association; Paul M. Lincoln, of Pittsburgh, president of the American Institute of Electrical Engineers; Homer E. Niesz, of Chicago, Jupiter of the Jovian Order; C. V. Hard, of Wooster, O., president of the Ohio Electric Light Association; and a number of others, including Mr. Tait himself. Mr. Tait has been connected with the Dayton plant for more than 10 years, and has won tremendous popularity, as the quality of the men attending the dinner attested; and at the same time he has built up the company to a high point of efficiency. He retains the presidency of the concern, as recently announced, but will be able to give it only a small amount of attention as compared to his former active personal supervision.

Popular Lectures on Illumination.

At a meeting of the Council of the Illuminating Engineering Society, held in New York City on May 13, the Committee on Popular Lectures reported through Prof. C. E. Clewell that the manuscripts of the first two lectures on store and residence lighting, respectively, would be submitted shortly for approval of the council. The committee has in the course of preparation five popular lectures on industrial, store, office and residence lighting, and one on the fundamentals of light and illumination. It is intended that these lectures will present in simple and attractive form the elementary principles involved. Copies of each lecture, together with suitable lantern slides, will be available for loan to those who desire to give popular talks on lighting.

Hydroelectric Units.

A joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, is to be held on the evening of May 24. E. B. Ellicott, electrical engineer of the Sanitary District of Chicago, will present a paper on "Ten Years of Evolution in Hydroelectric Units." The meeting will be held in the Western Society rooms, Monadnock Block, Chicago.

Louisville Jovians Moving Ahead.

Louisville's Jovians are finding work for their treasurer to do, something which has been heretofore a novelty, not only with the Louisville organizations but with some others. Robert Montgomery, when he was elected president of the organization, several weeks ago, stated that his chief endeavor would be to put the order on its feet financially. One of the first acts was to provide a series of buttons, big, red affairs, four inches in diameter, each containing the name of the wearer and the name of his business. By this means every man can immediately identify every other man, and good fellowship is increased. But it was also provided that any man who came to the weekly luncheon meetings without his button must pay a dime into the treasury. This was one of the nuclei of the bank account.

Another means by which the fund will be added to is the "moonlight excursion," which will be taken by the Jovians and their friends, up the Ohio River on the steamer *Corona*. The date is the evening of May 25 and the boat will leave the wharf at the foot of First Street at 8 o'clock. Two weeks before the date of the excursion enough tickets had been sold to more than pay the whole of the expenses of the trip and there are many others who have not been approached. The membership of the order was increased to 125 by the last rejuvenation and every week there are between 40 and 50 in attendance at the noonday luncheons.

Electrical Men Lead in Louisville Rotary Club.

"The Live Wire Ticket" is the designation that has been given to one set of nominees for officers in the Louisville Rotary Club for the election which is soon to take place. The name comes from the fact that the majority of the nominees on this ticket are connected with the electrical industry in one way or another. W. C. Daviet, district manager of the Postal Telegraph-Cable Company, is named for the office of president; James Clark, Jr., of the James Clark, Jr., Electric Company, for first vice-president; Robert Montgomery, commercial manager of the Louisville Gas and Electric Company, for the office of second vice-president; L. K. Webb, district manager of the Cumberland Telephone and Telegraph Company, and Fred G. Burdor, of the Burdor-Brecher Company, for directors.

Electrical Exports for March.

The following data on the electrical exports of the United States for March are from the official government report on the foreign commerce of that month issued by the Bureau of Foreign and Domestic Commerce.

In total value the electrical exports in March showed a marked decrease from the encouraging totals of January and February. As compared with March, 1914, there was a slump of about 21 per cent; however, that month was the best one in the year 1914. In the four classes for which numbers of articles shipped are given, there were exported last March: Electric fans, 1,576; arc lamps, 117; carbon-filament lamps, 73,701; metal-filament lamps, 286,045.

In the following table are given the detailed figures for the various electrical classes reported, with corresponding figures for March, 1914:

Articles.	March, 1915	March, 1914
Batteries	$ 166,041	$ 47,304
Dynamos or generators.	236,305	376,985
Fans	20,533	54,718
Insulated wire and cable	236,849	154,696
Interior wiring supplies, etc. (including fixtures)	65,159	50,182
Lamps—		
Arc	2,409	2,686
Carbon-filament	8,133	14,697
Metal-filament	42,963	14,188
Meters and other measuring instruments	41,305	.....
Motors	166,648	292,991
Static transformers	27,562	92,903
Telegraph instruments (including wireless apparatus)	7,335	6,062
Telephones	53,066	59,295
All other	587,363	937,625
Total	$1,661,671	$2,104,332

Memorial to Wireless Operators.

The memorial drinking fountain and cenotaph at Battery Park, New York City, erected to the wireless operators who perished at sea in their line of duty, was formally presented to the City of New York on May 12 by Fred B. Dalziel, chairman of the committee of the Maritime Association.

The cenotaph was draped with the Stars and Stripes and crowned with a laurel wreath, and the chairs of the guests were roped off with laurel also. Four sailors from the Navy Yard were present with two buglers, who blew "taps" when the unveiling took place.

Mr. Dalziel, in presenting the fountain to Acting Mayor McAneny, spoke of the fidelity to duty of the wireless heroes at sea and specially mentioned Jack Phillips, who lost his life on the *Titanic* and in memory of whom the fund was started.

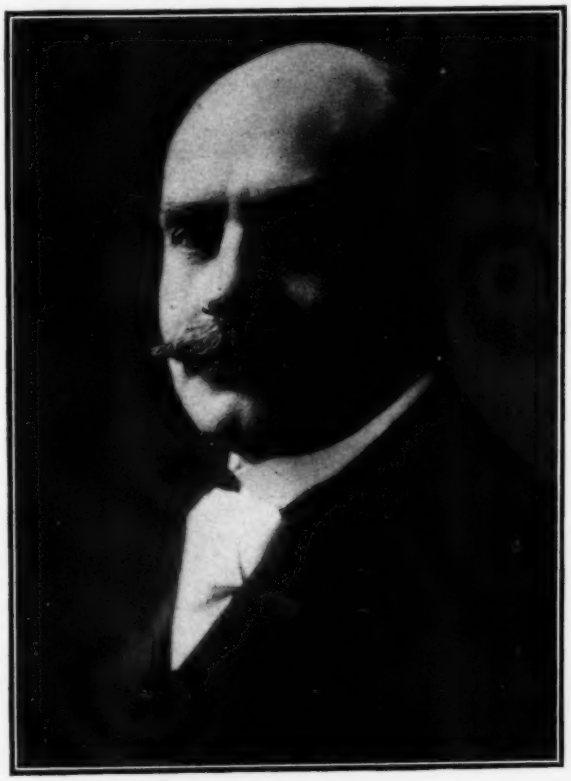
The names inscribed on the cenotaph are George C. Eccles, Stephen F. Sczepanek, Jack Phillips, Lawrence Prudhunt, Donald Campbell Perkins, Clifton J. Fleming, Harry Fred Otto, Adolph J. Svenson, Ferdinand Kuehn, and Walter E. Reker.

The names of the wireless operators who sank with the *Lusitania*, Robert Leith and D. McCormick, will be added.

Lamar Lyndon.

An engineering undertaking that has attracted wide attention because of many difficulties to be overcome, has been completed. On other pages of this issue there is presented a description of the great dam near Austin, Tex., and a story of the outstanding engineering features in connection with this development of electrical energy. The bringing to completion of this great work is an engineering achievement of extraordinary degree. The personality of the engineer responsible for the designing and execution of the work evokes our interest, and it is a pleasure to chronicle something concerning Lamar Lyndon, and to present his portrait on this page. Mr. Lyndon has demonstrated once more the importance of the personal equation in a great undertaking.

Mr. Lyndon is well known to the profession not only as an eminent consulting engineer, but as the author of standard works on various engineering subjects. He was born in 1871, at Newnan, Ga. His technical education comprised seven years of training in the University of Georgia, Stevens Institute of Technology and Cornell University. Immediately upon leaving Cornell University, he entered practical engineering work, being given the management of the Bailey Iron Works, at Athens, Ga. He relinquished this position to become engineer of the Athens (Ga.) Gas and Electric Company and, later, became associated with a firm of consulting engineers of New York City. In 1896 he went abroad to represent an American syndicate. For three years he was engaged in general engineering work in Japan, China, Burmah, India, Straits Settlements, and, afterwards, in England. A young man, left entirely to his own resources in countries where engineering advice and cooperation are not available, cannot help deriving great benefit from such an experience. It puts him on his mettle, and his success becomes a direct measure of his resourcefulness and ability to cope with new problems without assistance. Part of the time spent abroad was in the capacity of resident engineer of the American Trading Company in Yokohama and Kobe, Japan. In 1899, Mr. Lyndon was made chief engineer of that company with offices in New York, but he did not remain long in this position, resigning a year later in order to engage in consulting engineerig practice, in which occupation he has since continued. He was consulting engineer for the National Battery Company, of Buffalo, during a period of three years, and later consulting engineer for the General Storage Battery Company, of New York, and Boonton, N. J. This work enabled him to become thoroughly acquainted with the conditions of a great many plants through data supplied by the operating companies. At the same time the work of designing dynamos, both direct-current and alternating, some of special types, of boosters, of controlling and regulating devices, etc., consumed much of his time. Hydroelectric power plants formed another and important phase of his work. Among the many power plants designed by him may be mentioned those at Rockaway River, at Boonton, N. J.; the rehabilitation of the Juniata Water Power Company's plant on the Juniata River, etc., and, recently, the plant now under construction at Austin, Tex., in which the dam is one of the largest in the world and the lake formed by this development one of the largest artificial bodies of water known. Mr. Lyndon's reports on various engineering enterprises and public utilities are models of thoroughness and of conscientious effort. His clear insight and freedom from bias have earned him an enviable reputation in this line. He has frequently been called to arbitrate in disputes and disagreements arising between contending parties in various engineering undertakings, and between cities and public utility corporations. In addition to the practical work which he has done, his contributions to technical literature are of considerable importance. He was one of the board of experts who prepared Foster's "Electrical Engineer's Pocket Book," being the author of the sections on storage batteries and on resonance in alternating-curent circuits. He edited the sections on electricity and magnetism in the "United Editors' Encyclopedia," and collaborated in writing the section on traction in the new Encyclopedia Britannica. Among his books, "Development and Electrical Distribution of Water Power" and "Storage-Battery Engineering" are regarded as standard works. The latter has been translated into French. Both are used as textbooks in many universities and technical schools in this country.



Lamar Lyndon,
Consulting Engineer.

It is not only as an engineer that Mr. Lyndon has attracted marked attention. Few men there are who so indelibly impress even upon casual acquaintances so much of individuality as a characteristic. Generous and genial, equipped with an unfailing good humor, witty and sharp indeed in repartee, Mr. Lyndon has endeared himself in remarkable fashion to a host of admiring friends. On the witness stand he has figured in the capacity of an expert upon many occasions, and his skill in fencing off attacks, his clever rejoinders, as well as the earnestness and inflexibility of his position, make him a most valuable witness in a good cause, and a dangerous foe in a bad one.

The completion of the work at Austin so successfully will be a source of great satisfaction to his engineering friends and acquaintances.

Electric Elevators in Bombay.

The increasing number of electric elevators in the Bombay Presidency, India, has caused the Bombay government to announce that it will lend the services of electrical inspectors to the owners of such lifts for the purpose of insuring greater safety. Since the introduction of electric power the number of lifts in the Bombay Presidency has considerably increased and the rate of increase will undoubtedly be much more rapid in the future. In Bombay the principal hotels and offices, the larger shops, and most of the recently constructed flats, and several private houses are fitted with elevators.

Annual Election of American Institute of Electrical Engineers.

The 309th meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York City, on the evening of May 18.

The meeting was called to order by President P. M. Lincoln. Announcement of the results of the election of officers showed the following to be elected: President, J. J. Carty; vice-presidents, C. A. Adams, J. F. Stevens, William McClellan; managers, John B. Taylor, Harold Pender, C. E. Skinner, F. B. Jewett; treasurer, George A. Hamilton. The annual report of the Board of Directors was also presented.

The principal event of the evening was the presentation of the Edison medal to Alexander Graham Bell, during which S. S. Wheeler presided. The presentation was made by J. J. Carty, and an address was made by Thomas A. Watson on "How Bell Invented the Telephone," which was of unusual interest and received with marked attention. Dr. Bell made a felicitous response in accepting the medal.

The auditorium and galleries were crowded at this meeting, ladies as well as members being in attendance. Music was furnished during the evening by the Bluebell Orchestra of the New York Telephone Company.

Electric Club of Chicago Makes Important Change in its Constitution.

At the meeting of the Electric Club of Chicago on Thursday, May 13, the constitution and by-laws were changed so as to make the name of the club "The Electric Club-Jovian League."

This important change was made after the presentation of a resolution by A. L. Millard and W. R. Bonham. There was very brief discussion, and the motion prevailed unanimously.

Alexander Graham Bell and Thomas A. Edison, upon motion of H. A. Mott, were made honorary members of the club. Upon motion of P. B. Woodworth a resolution was adopted requesting Mayor Thompson to retain Ray Palmer as Commissioner of Gas and Electricity of the city of Chicago.

His Honor, Mayor William Hale Thompson, greeted the members and made a brief address respecting his ambitions for bringing good government and prosperity to the city.

Fire Prevention Discussed by Chicago Jovians.

On Monday, May 17, J. C. McDonnell, of the City of Chicago Fire Prevention Bureau, discussed at some length the methods and features of administrative co-operation of the Bureau.

The action of the Electric Club in changing its name to The Electric Club-Jovian League was presented in the form of a resolution, and at the next meeting, Monday, May 24, the Chicago Jovian League will vote on a resolution to cease its existence as a separate organization and become consolidated with The Electric Club-Jovian League.

Transportation Arrangements for American Electric Railway Convention.

The annual convention of the American Electric Railway Association and its five affiliated associations of accountants, engineers, claim agents, traffc managers, and manufacturers, will be held at San Francisco, Cal., on October 4 to 8, inclusive. Arrangements are being made to make this an exceptionally interesting and memorable gathering. The Transportation Committee is very active in its efforts to provide for luxurious and scenically attractive tours to and from the Coast on special trains.

Three specials have been tentatively planned, as follows:

Tour A, Red Special.—Leave New York City about September 23, passing through or stopping over at Buffalo, Cleveland, Chicago, Minneapolis, Glacier National Park, Seattle, Tacoma, Portland and Shasta Springs, arriving at San Francisco on October 2. Leave about October 9, stopping over or passing through Yosemite National Park, Los Angeles, Pasadena, San Diego, Riverside, Grand Canyon of Arizona, Albuquerque, Kansas City and Chicago. Total time of trip, including stay in San Francisco 30 days.

Tour B, Blue Special.—Leave New York about September 26, passing through (with stops) Philadelphia, Pittsburgh, Indianapolis, St. Louis, Kansas City, Denver, Colorado Springs, Royal Gorge, Glenwood Springs, Salt Lake City, Ogden and Lake Tahoe, arriving at San Francisco on October 3. Leave there after a week's stay and follow the route of the Red Special, making all stops at practically the same time to St. Louis and New York. Total time of trip, including stay at San Francisco, 27 days.

Tour C, White Special.—This is to be a specially fast train leaving Chicago in time to reach San Francisco on October 4. This is to be a going trip only. Passengers on this train desiring to return on the Red or Blue Special must make early reservations.

For reservations and detailed information as to total expenses, itineraries, etc., those interested should communicate with H. G. McConnaughy, 155 Broadway, New York City.

Advertising Electric Vehicles.

The regular monthly meeting of the Philadelphia Section of the Electric Vehicle Association of America was held May 12 in the Colonnade Hotel.

The speaker of the occasion was R. T. Snodgrass, representing N. W. Ayer & Son, national advertisers. In opening his remarks, Mr. Snodgrass announced that he had not given the subject of electric-vehicle advertising any particular study, but that he would touch on the subject from the point of view of general advertising knowledge.

He stated that advertising in general always made more work and not less work for the salesmen, inasmuch as it brought to them a much larger number of possible buyers. He also stated that no article was worthy of conscientious advertising that was not in itself already on a sound, successful basis, that advertising was not intended to make a good proposition out of a poor one, but was intended to bring increased sales and thereby enhance the value of such an article that had already demonstrated itself as either useful or desirable.

The speaker called attention to the success in the field of gasoline-car advertising, and stated as his opinion that imitation among the advertisers and others of the United States was developed to a very high degree. In fact imitation runs rampant, not only in advertising, but in all things with which the American public is interested. In all the world, the Japanese only are the equals or superiors of Americans in this somewhat questionable trait of character. Mr. Snodgrass suggested that advertising of electric cars should appeal particularly to women. No details of the mechanical construction should be advertised. Keep away from the gasoline row. In fact the salesrooms of electric cars should be placed in the shopping district, where they would be bound to attract the attention of the women. He called attention to the advisability of women demonstrators, stating that it is his firm belief that no man can as well reach those traits in a woman's character, which it is necessary to reach, to create a desire for a luxurious electric car. After this desire has been created, he would have the prospect turned over to a man salesman.

The speaker outlined a general plan for a complete advertising scheme, modestly stating, however, that this was his suggestion from a casual inquiry into the subject and was not the result of careful study. He concluded by stating that for any complete salesmanship, enthusiasm for one's product, a quiet confidence in the absolute end and capacity of his product to fulfill the desires or necessities of the proposition was essential to success.

The New Austin Dam and Power Plant.

This development, just completed after three years of work, presents several new and extraordinary features of design and construction.

The principal, original and noteworthy departures from general practice are the two sections of dam having crests at different elevations; the automatic crest gates; the arrangement of the sluice gates; and the reinforced-concrete turbine chambers.

In May, 1893, the first dam across the Colorado River near Austin, Tex., was completed, and the electrical power and pumping plant, which was driven by the water power derived from the impounded waters of the dam, put into operation.

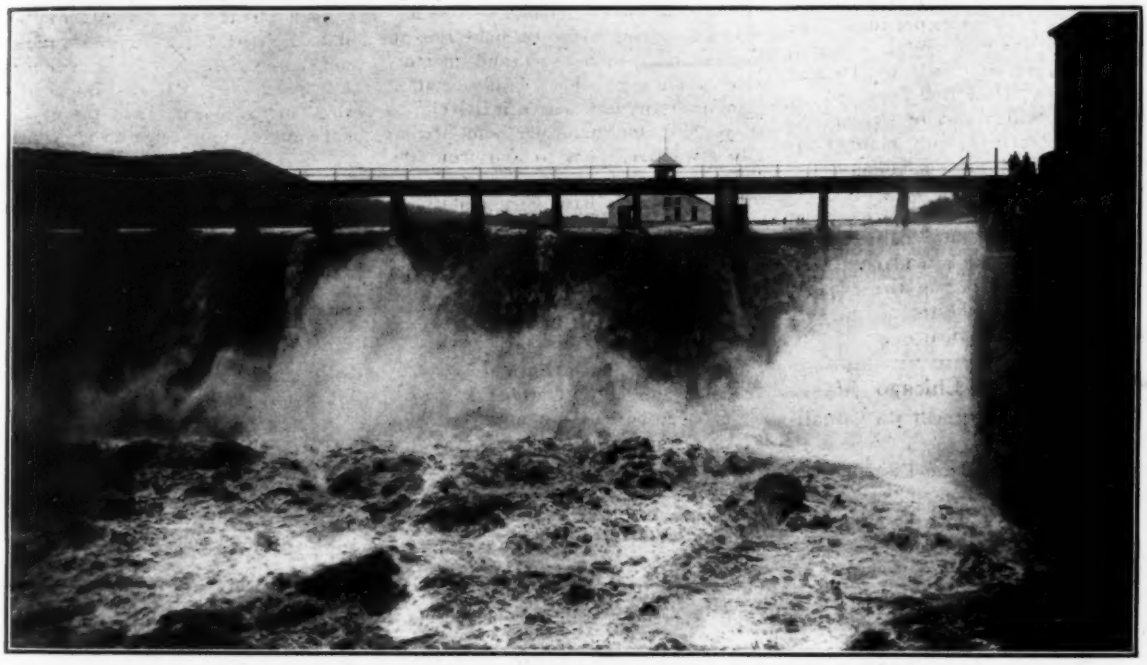


Fig. 1.—The Austin Dam During the Flood of April 25.

At that time, the development attracted world-wide attention, due to the fact that it was then the greatest dam in the world, when both height and length were considered, and the lake formed by it was one of the largest artificial bodies of water ever impounded.

The dam was a gravity section made of cyclopean concrete masonry, and overlaid on both the upstream and downstream sides with cut, red-granite blocks. Its height was 60 feet above low water and the total length was 1,235 feet, of which about 1,100 feet was spillway, 110 feet bulkhead on the eastern end, and 25 feet bulkhead on the western end.

The whole development was a municipal undertaking, the money being raised on bonds of the City of Austin, of which $1,400,000 were issued.

The entire river bed for many miles up and down stream, and, in fact, practically all the underlying rock of the county, is limestone, varying from so-called "dobe," which is a disintegrated limestone, up to the hardest variety. The river bed is seamed with fissures, and there are small cavities of frequent recurrence, ranging from a few inches to several feet in the largest dimension, and these cavities are encountered sometimes as far as 20 feet below the surface of the river bed.

The draft tubes from the old power station were so located that they discharged against the down-stream toe, and the waters from these draft tubes eroded the soft strata underenath the toe. This condition continued for seven years, when the inevitable end was reached.

On April 7, 1900, under a flood of 133,000 cubic feet per second, which gave a thickness of water of nearly 11 feet over the crest, a section about 200 feet long tilted backwards and slid down stream, righting itself as it moved, and finally came to rest about 100 feet below the axis of the dam. The impounded waters rushing through the opening formed, eroded the remaining portions of the dam, thereby widening the gap until some 450 feet of the total length of the dam was thus removed. The power house was wrecked, and several people were drowned.

About six years ago, the municipality had a series of rock borings made, with the result that it was found that the underlying rock was good, hard, and compact after a certain depth below the river bed, and below the footing of the old dam, was reached. This encouraged the citizens and municipality to undertake some means whereby the dam could be rebuilt.

A franchise was granted to William D. Johnson, of Hartford, Conn., on September 11, 1911, which provided that the dam and power plant would be constructed by Johnson or his assigns, and on completion, turned over to the city, Johnson to receive $100,000 in cash on completion and acceptance, and $64,800 per annum in semi-annual payments for 25 years, making a total payment of $1,720,000, the cash value of which is approximately $1,000,000. In order to carry out the terms of the franchise and to do the construction work, a corportation was formed called the City Water Power Company, which issued $750,000 face value of five-per-cent, gold, sinking-fund bonds, and these bonds were underwritten by Lawrence Barnum & Company, of New York City.

The designs for the new development were begun early in 1910, and work finally began on September 22, 1911. In June, 1912, a contract was entered into with the William P. Carmichael Company, of St. Louis, to take over the work and bring it to completion. Work progressed until April, 1913, after which almost nothing was done until January 10,

1914, the entire period between these latter dates being lost by reason of an unprecedented series of heavy floods culminating in the flood of December 3, which was the highest ever recorded in the history of the river, or memory of any person acquainted with it. It is estimated that the quantity of water passing down the river on that date was between 220,000 and 230,000 cubic feet per second.

After a considerable study of the situation, it was decided that the new development could be made best and most cheaply on the same site as that of the original dam. While the foundation work for the new dam was more costly than it would have been if the location were changed upstream some 800 or 900 yards, this expense was more than counterbalanced by the ability to use the existing section, which comprised 520 feet length of dam, in good condition and on satisfactory foundation, together with all the bulkhead masonry, which was thoroughly good, though not on proper foundation. Also, the larger portion of the old power house, still standing, could be utilized. The most suitable character of structure with which to fill the gap was decided to be a hollow dam, having an inclined deck, thus neutralizing the overturning moment, having buttress walls sunk well into the rock to resist sliding, and with a cut-off wall on the upstream side going down into a trench cut in the rock to such a depth that all waters would be definitely stopped from following any permeable seams.

Crest gates were placed between the piers, the gates on the old section being 6 feet high, and those on the new section, 15 feet high, so that the upper edges of the crest gates are all at the same level, which is 66 feet above low water. When the water level is at an elevation of 65 feet, or less, the crest gates are tightly closed. An increase of six inches in the elevation of the lake level will make the crest gates automatically overturn, letting the water flow out over the crest of the dam. When the level has fallen 12 to 15 inches, or about down to the 64-foot elevation, the crest gates automatically close. During periods of flood, the crest gates are open, and the greater portion of the flood water is taken over the crest of the new section. It is estimated that with a discharge of 200,000 cubic feet per second, the thickness of the water over the crest of the new section, will be 18 feet, the thickness of the water over the crest of the old section being 9 feet. This means that the present dam will pass 50 per cent more water than passed over its crest when the old dam failed, but the elevation of the water is only 9 feet above the crest of the old dam, while it was 11 feet above the crest when the weak section went out in 1900. Since the overturning moment varies as the cube of the head of water against the dam, and the sliding force varies as its square, the stresses to which the old section will be subjected can never equal those which it has already resisted. The depth of the water below the low-water elevation varies from 5 to 20 feet, so that the total depth of water behind the dam varies from 70 to 85 feet.

The total length of dam and corewall is 1,535 feet, of which 1,091 feet are spillway, 124 feet bulkheads, and 300 feet corewall. It is a reinforced-concrete structure, having an inclined upstream wall, making an angle of 42 degrees to the horizontal. At a point about 2.5 feet above low-water level, this slope of the wall ends, intersecting a narrow horizontal bench and from the up-stream edge of this horizontal bench a vertical wall goes straight down into the rock. This vertical wall forms both the lower portion of the deck and the cutoff wall.

The object of the bench is to allow flow of water through any completed section of the dam during construction, the flat horizontal slab, which runs the entire length of the dam, and covers the upper part of the bench, being omitted until the completion of the work.

The supporting walls are both longitudinal and transverse. The transverse walls are set parallel to the flow of the stream and are 20 feet apart, measured from center to center. The longitudinal walls are also spaced 20 feet apart, measured from center to center in a direction at right angles to them. These latter walls are not vertical but are inclined, so that they form an angle of nearly 90 degrees with the upstream deck. The slope of these walls is such that the resultant of the forces which they resist, made up of the water pressure acting against the surface of the deck and the gravity component of the deck and the walls themselves, has the same direction as that of the longitudinal walls. The longitudinal and transverse supporting walls intersect at right angles and form a series of square openings when viewed in a direction normal to the deck. The deck panels are exact squares, and hence may be reinforced in two directions. The reinforcing steel is, therefore, placed both longitudinally across the length of the dam and transversely up and down the deck. The spacing of the steel is logarithmic, the bars being laid closer and closer together as they get nearer and nearer the middle of the panel.

Fig. 2.—The Austin Dam With Crest Gates Closed.

The stresses allowed in the steel are 16,500 pounds per square inch maximum.

All of the steel used was re-rolled twisted bars, having an elastic limit above 55,000 pounds. The engineers considered the high elastic limit preferable to a high ultimate tensile strength, it being assumed that if stresses were imposed on the steel which would extend it past its elastic limit, the surrounding concrete would be probably crushed to such an extent that the structure would fail, and the only value that the steel could have lies in its resistance to distortion within its elastic limit.

An ample number of expansion joints is provided in the new dam, every fifth panel being an expansion panel. There are 28 panels in all. These expansion panels have both the upstream deck and the spillway entirely separated from the adjacent portions of deck and spillway on either side of them. A joint is made between the two abutting edges of the

concrete slabs which is water-tight, but which permits lateral movement of the different sections of the dam without diminishing the tightness of the joint or rupturing any of the masonry. This joint is made of "ingot" iron plate, 0.5 by 8 inches. One-half the width of the strip is cast into the concrete of the abutting edge of a standard panel. This leaves four inches of metal projecting out from the surface of the end of the panel. The end of the slab, together with the projecting iron, is painted over with a heavy coat of asphalt. The expansion panel is then cast so that its edge abuts against the edge of the slab of the standard panel. Due to the asphalt coating, the concrete cannot adhere to the metal of the expansion strip, nor to the adjacent concrete, while that portion of the iron strip cast into the standard panel and adjacent to the expansion panel, does firmly grip the metal. In this way, a water-tight, sliding joint is formed.

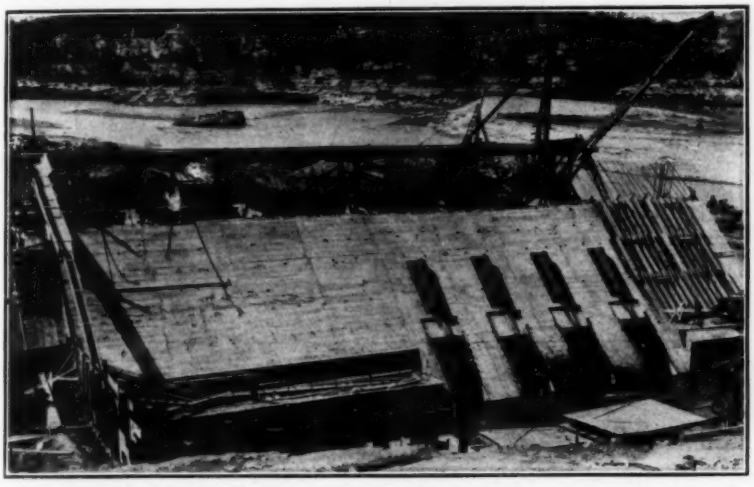


Fig. 3.—Dam Under Construction, Showing Two Pairs of Sluice Gates.

A bridge is built across the top of the dam, being supported on the piers. This bridge comprises two reinforced-concrete beams, each 1 foot thick and 2.5 feet deep, spaced 4 feet apart, center to center, and covered with a concrete slab 8 inches in thickness. On top of this slab are placed standard 6-by-8 inch cross ties, 8 feet long, and a standard-gauge railway track is laid on these, the rails coming approximately over the beams. The ties are floored over and a pipe railing is put on the down-stream side of the walkway thus formed. The railway track serves to carry a heavy steel derrick car across the bridge, and a railing on the up-stream side is omitted so that there is nothing to interfere with the operation of the tackle of the derrick car in case it is desired to move any portion of the gates for repairs, or lift out.

The crest gates, which are placed between the piers that project upward beyond the crest of the dam, on both the high and low sections, are made up of a structural-steel framework, of which the lower portion is filled with concrete, while the upper part is covered with creosoted yellow pine. There are 28 large gates and 26 small ones, making a total of 1,091 feet of spillway. These gates turn about rockers or bascules, which are fastened into the piers at either end of the gate. The large gates, which are placed on the low section of the dam, have, in addition, a middle bascule to support the middle and take the heavy water pressure, due to the great size of the individual gates. These large gates are, of course, continuous from pier to pier, and the middle bascule is placed on a low pier built entirely in the rear of the gate, the bascule projecting forward so that a portion of the rear surface of the gate rests against it. When the gates are vertical and the water is at normal height, the center of pressure coincides in elevation with the point of support on the bascule curve. When the water rises above the normal level, the center of pressure likewise rises, and there then exists a net moment to cause the gate to overturn. As overturning begins, the moment to cause it increases, due to the increase in pressure on the upper portion of the gate, and the diminution in pressure on the lower part. This increase in overturning moment is compensated for by the fact that the gate turning around the bascule is continuously changing its point of support, this point moving from a position at one-third the height of the gate to one very near the middle of the gate when it is, finally, in a horizontal position.

When the level of the water in the lake sinks sufficiently, these gates automatically close. This is effected by the counter-weighting provided by the concrete filling in the bottom of the gates, so that the center of gravity of the gates is near the bottom, and there is a continual tendency for gravity to restore them to their normal, vertical position.

These gates have not only operated in a thoroughly satisfactory manner, but have passed one heavy flood, together with some 50 or 60 acres of driftwood that came down the river and accumulated in the lake prior to the full opening of the gates. In this latter respect, their performance is remarkable. When one of the large gates opens and 14 feet thickness of water begins to pass over the crest, the volume and velocity of discharge carry large trees through the space between the piers, and over the upper surface of the gates, and when the spread of the brances of these trees is greater than the openings between the piers, the force of the water breaks up the limbs and carries the broken trees through without difficulty.

The advantage of these gates under these particular conditions is obvious, and, by their use, the lake level undergoes no substantial change between the lowest and highest river stages, the minimum level being about 14 inches below the normal and the maximum level for heavy floods is not more than 34 inches above the normal level.

There are eight sluice gates, set in pairs, each discharging into its own opening; the two individual channels merging into one large tunnel, which passes through the dam. The gates are each 5 by 6 feet and are operated by pistons working in cylinders, the working fluid being oil under a pressure of 750 pounds per square inch. The direction of the water is changed on entering the throat of the sluice-gate passageway through a gradual curve until the direction of flow becomes horizontal, and the channels increase in area gradually so that practically no eddy currents are formed until after the two individual channels merge into the single large one, which passes through the bottom of the dam. Since this single channel is 18 feet wide, and approximately 14 feet high, the total area is 250 square feet, while the area of the openings of the two sluice gates is only 30 square feet each, or 60 square feet for the two. The velocity of efflux through the sluice gates will be about 60 feet per second, while the velocity through the main channel will be less than 15 feet per second.

It is to be noted that the oil-pressure cylinders which operated the gates are placed on the outside of the deck of the dam instead of inside the dam, as is usually customary. In this way the cylinders could be placed much nearer to the sluice gates than is possible when the cylinder is inside the dam, and the sluice gates outside, with the thickness of the inset of the dock wall between the two. This, of course, shortens the piston rod,

which, when the gate is being closed, acts as a long column, and for a given diameter of rod it is stiffer, or for a given pressure a smaller rod may be used. This means that the size of the cylinder may be somewhat reduced.

A Deane triplex pressure pump, having a capacity of 40 gallons per minute, under a pressure of 850 pounds per square inch, is installed in the power station and driven by a Western Electric induction motor, which is belted to the pump. A pressure bypass is provided so that the pump can work continuously when the gates are being operated and any excess pumpage will pass from the discharge to the suction pipe, the bypass valve between the two opening when the predetermined pressure for which it is set has been reached. The high-pressure service pipe, and the low-pressure pipe for return of oil to the suction side of the pump, run from the power house into the dam and pass along the side of the walkway through the dam, these two pipes forming two of the three railings on one side of the walkway.

The gates themselves are heavy slabs of cast iron, about 1.5 inches thick, 5.6 feet wide by 6.6 feet long, the smaller dimension being the transverse one. Each gate slides on a heavy, cast-iron, framework which is sunk into the concrete. The upper side of the gate frame and the under face of the gate are both lined with bronze strips 2 inches wide by three-eighths inch thick. These gates have been operated a number of times under varying depths of water, and have proven themselves satisfactory in every particular.

Head Works and Penstocks.

The head works are located in the masonry bulkhead on the east side of the river. These comprise three openings to penstocks, each opening and penstock being 9 feet in diameter. The penstock openings are each divided into two. This is effected by the use of an H-column running vertically across the face of the flange, at the inner end of the penstock. There are, therefore, two headgates to each penstock, each headgate being 5 feet wide by 10 feet in height. The gates themselves are made of four-inch, creosoted, yellow pine, bolted together, and braced by sections of angle-iron, which are fastened to the wood by means of lag screws. One of each pair of gates is provided with a filler gate, which was specially designed and made unusually heavy, owing to the depth of water over the headgates. In times of drought, the water in the lake may be lowered 15 feet, and, at this elevation, the water will be three feet above the top of the penstocks. At its normal elevation, therefore, the water is 28 feet above the bottom of the headgates.

A hand-operated, worm-gear headgate hoist, made by the Platt Iron Works Company, is provided for each of the six headgates.

There are three penstocks, each being 9 feet in diameter, and made of steel plate, 0.25 inch thick, which is covered on the outside with concrete. The exterior of this concrete is hexagonal in form, and it is eight inches thick at its thinnest section. The concrete is reinforced with steel-wire mesh, and, by this construction, strong and permanent conduits have been provided. As a precaution against water hammer, surge pipes are connected with the penstocks, there being one to each penstock and joined to it at the point nearest to the turbine casing that is available. These surge pipes leave the penstocks horizontally, pass through the wall of the power house on the stream side of the building and

Fig. 4.—Exterior of Power House, Showing Draft Tubes and Surge Pipes.

then turn vertically upward, being anchored to the wall of the building.

Just after passing through the power-house wall, each penstock is turned downward to the opening in the turbine casing, and this condition is one which is liable to produce collapse of a penstock, if the water-wheel gates are rapidly opened, unless some provision against this is arranged. To prevent this, a vertical vent pipe is placed on each penstock, just outside the power-house wall. Two of these are 66 inches in diameter each and one 48 inches in diameter, and the height of these vent pipes is such that the water normally stands in them about 4 feet from the top. It has been found, in practice, that these vent pipes not only act to prevent collapse of the penstocks, but act also as surge pipes. When the water-wheel gates are rapidly closed, water is ejected from the surge pipes before described, and also from the vent pipes.

Power House.

The power house is built of yellow, pressed brick and measures 118 feet long by 50 feet wide, inside measurement. The wall on the side of the river is 90 feet in height. The height from the generator room floor to the top of the walls is 28 feet in the clear. From the generator floor down to the concrete floor in the bottom of the power house, on which the turbines are set, is 40 feet. From this lower level, down to the foundation, the construction is of ashlar masonry, the brick walls being built on top of these ashlar footings. Figs. 4 and 5 are photographs of the exterior and interior respectively.

The generator floor is of reinforced concrete, supported at intervals on reinforced-concrete beams. At the places where the three vertical generators are placed, large circular holes have been cast in the floor, having a diameter just one foot less than the generator frames, so that the generator has a six-inch width of support all the way around these openings. Since the generators are 10 feet in diameter, these holes are 9 feet in diameter, so that they are of ample size for handling any of the turbine parts below, in case repairs or changes should become necessary.

The walls of the power house vary from 2 feet to 3 feet in thickness. Interior pilasters are provided against both the longitudinal walls, which serve as supports for the crane runway. In addition, the longitudinal wall opposite to the wall on the stream side has three heavy, external buttresses, which run the entire height of the wall.

The roof trusses are made up of timber compression members and round iron tension members, the roof covering being of slate.

A gallery is built inside the power house, six feet in width, and nine feet above the operating floor. This runs around three sides of the building and is guarded by an elaborate railing of nickel-plated iron pipe.

The equipment comprises three vertical, or "umbrella-type" generators, each of 1,800 kilowatt capacity, built by the Crocker-Wheeler Company. They are three-phase, star-wound, revolving-field machines and generate current at 6,600 volts, which is the voltage of transmission, no step-up transformers being used. Each of these generators is driven by a pair of 36-inch turbines, built by the Platt Iron Works Company. Each pair of wheels is mounted on the same vertical shaft with the generator rotor, and is set in a cylindrical chamber of reinforced concrete.

The generator rotor, the shaft and the water wheels attached thereto, are all suspended from a thrust bearing placed on top of the generator frame. This bearing, together with the heavy box girders underneath that support it and form part of the upper cover of the generators, is clearly visible in the picture showing the interior of the power sta-

tion. The turbine and generators run at a speed of 300 revolutions per minute. The weight of the rotating parts, supported by the top thrust bearing, is 44,000 pounds. The water wheels are, however, designed to produce an upward thrust, when in operation, using the pressure of the water in the turbine cases to produce this upward pressure, which amounts to about 24,000 pounds, leaving only 20,000 pounds as the net weight to be carried by the thrust bearings. The bearings are, however, designed to carry 44,000 pounds at 300 revolutions per minute. Each of these thrust bearings comprises 34 two-inch hardened-steel balls, running in tool-steel grooves, there being two tracks concentric with each other, one carrying 15, the other 19 balls. They were made in Sweden by the S. K. F. Company, and were mounted in place by the builders of the generators.

In addition to the supporting thrust journals at the top of the generators, there are four additional journals to each unit, namely, two journals for the generators, one at the top and one at the bottom of the frame, a centering journal at the top of the turbine cases and a bottom one for the turbine shaft, which latter is a submerged journal, and, therefore, made of an iron frame, in which are placed adjustable lignum-vitæ blocks.

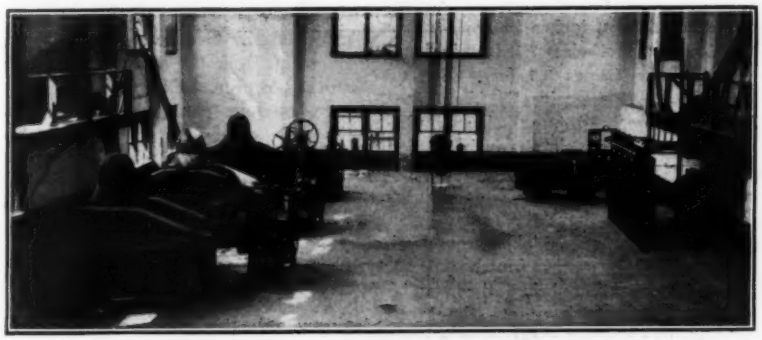


Fig. 5.—Interior of Power House.

There are three exciters, two being motor-driven and one belt-driven, all built by the Crocker-Wheeler Company. The motor-driven exciters are 125-volt machines driven by 440-volt induction motors, each of 75 kilowatts capacity, which is more than ample to supply full excitation to all three of the generators, and, therefore, these two exciters are never operated in parallel, one being a reserve unit. The belt-driven exciter is a small 15-kilowatt machine, the purpose of which is simply to start the plant when it is first put into operation, or to re-start it in case it should ever be shut down by accident or otherwise. This small machine gives a sufficient excitation for any one generator, and by its use, normal voltage may be established across the generator busbars and the motor-driven exciters brought into operation, after which the operation of the belt-driven machine is stopped. The speed of each of the turbines is controlled by a Lombard governor, Type P, having 17,500 foot-pounds capacity. The arrangement of these governors and connection with the turbine gate shaft, is shown clearly in the picture of the interior of the power station.

It is believed that this is the first time that turbines of comparatively small size, and adapted for setting in cylindrical steel casing, have been placed in a cylindrical casing of reinforced concrete. The question of a cylindrical chamber as compared with the usual spiral form, resolved itself in favor of the cylindrical casing, because it was believed that if the latter were made of sufficiently great diameter, the efficiency obtained would be nearly equal to that which could be obtained from the spiral form of casing, and, owing to the labor conditions on form work, it cost considerably less to make a large cylindrical casing than a smaller spiral-shaped one. The tests of the completed plant have amply demonstrated that this view was correct, an efficiency of 87 per cent for the turbines having been reached under actual operating conditions. It will be observed that the reinforcement of the casings comprise both cantilever and hoop-tension reinforcement. Also, in view of the possibility of cracking of the concrete, the amount of steel used was considerably greater than that customarily employed for ordinary, reinforced-concrete work, the stresses being limited to 10,000 pounds per square inch, in the steel. Where the penstocks enter the turbine cases, and where the draft tubes pass through them, angles are riveted around the outer surface of the pipes so that ample contact with the surrounding concrete is provided. These cases have now been in service nearly four months, and have not shown any cracks or defects. These cases were made of concrete instead of steel, principally because of the height of the vertical turbines and the possibility of vibration unless heavy masses surrounding them were provided of sufficient inertia to prevent any vibration.

The top of each turbine chamber is closed in by a heavy, cast-iron cover, which is ribbed to give a sufficient strength to resist the upward thrust of the water and which is split to facilitate erection and dismantling. A cast-iron ring of approximately Z section, and carrying a number of ribs from one flange to the web of the Z, is sunk into the concrete at the upper end of the casing, and anchored into the concrete by means of 32 1.5-inch bolts. One flange of this ring projects slightly above the upper surface of the concrete and to it is bolted the cast-iron cover.

Below the generator-room floor, oiling galleries and steps to reach them are provided, so that any bearing can be reached without difficulty.

A hand-operated traveling crane made by the Whiting Foundry Equipment Company spans the building. It is of 15 tons capacity and travels on runways of T-rail, weighing 40 pounds to the yard, which in turn are supported on 18-inch I-beams, these latter resting on the interior brick pilasters, which have previously been mentioned. Heavy cast-iron plates are interposed between the top of the pilasters and the under side of the I-beams so that the pressure is uniformly distributed over the whole upper surface of the pilasters.

In the power station are also located the oil pressure pump, which serves to operate the sluice gates, together with the motor which drives it, and the oil tank containing the supply of oil for this service.

Switchboard.

The switchboard comprises seven panels, of which two are exciter panels, three generator panels, and one totalizing or outgoing feeder panel. The station voltage is 6,600 volts, and the oil switches are mounted on the wall in the rear of the switchboard, which latter is set seven feet from the wall. Each oil switch is operated by means of a handle, which is placed on the switchboard panel, motion being communicated from the operating handle to the switch by means of bell cranks and connecting rods of 0.75-inch pipe. In this way there is no high voltage at the switchboard itself, the maximum on the board being 125 volts.

The generator switches are non-automatic, manually operated. The main switch is manually operated, and has also a trip coil, overload release and a controlling relay. The board is of the usual standard type. The rheostats are all mounted on a gallery underneath the floor and operated by sprockets and chains. Since the motors which drive the exciters and the pump are all 440-volt machines, there are three station transformers provided which step down from 6,600 to 440 volts to supply current for these motors. On two of the trans-

formers there are additional taps from which 125 volts may be taken.

The station is lighted from the exciter busbars, but the lighting switches are double-throw switches, one side being connected to the exciter busbars, the other side being connected to the 125-volt taps of the two station transformers, so that current for station illumination may be taken from either source. Since the plant is intended to operate, at times, in parallel with the steam-driven electric plant of the city, some three miles distant, this arrangement provides for illumination, even if the water-power plant were shut down and out of commission, by reason of the fact that the steam power plant would supply current to the station transformers in the water-power plant.

The draft tubes leave the turbine casings at an elevation half way between the top and bottom of the case. The opening in the draft chest is 7 feet in diameter and to this opening is attached a short length of straight pipe 7 feet in diameter, which passes out through the turbine case. Just outside the turbine case is attached a short piece of pipe, which is in the form of a truncated cone, being 7 feet in diameter in one end and flared to 7 feet 6 inches at the other end. Attached to this piece of pipe is an elbow making a downward bend of 65 degrees. This elbow increases in diameter continuously from the 7.5-foot end to the lower end, which is 9 feet in diameter, so that there is a gradual increase in the diameter of the draft tube from 7 to 9 feet. To the lower end of this elbow is attached a straight piece of plate pipe 9 feet in diameter and this makes an angle with the vertical of 25 degrees. The lower end of this last tangent section is submerged 18 inches below minimum low water. The lower ends of these draft tubes are supported by concrete saddles, which are carried down to rock foundation and nearly surround the bottom of the penstock.

These saddles are so formed as to give a gradual change in the direction of the water as it passes the end of the draft tubes so that it emerges in an approximately horizontal direction. A draft-tube pit for the lower ends of these draft tubes to dip into is excavated in the rock, and of such dimensions that there is ample area for discharge of maximum amount of water that will ever be required through any of the draft tubes, or all of them simultaneously, and so that in no part of the pit will the velocity of the water exceed 3 feet per second.

The draft tubes, vent pipes and all steel-plate work were made by the Payne & Joubert Company, of New Orleans.

The tail race is about 300 feet long, running from the draft-tube pit out to the main channel of the river. It varies from 50 to 60 feet in width and from 3.5 to 5 feet in depth. At every point along it there is a clear waterway of 200 square feet measured below normal low-water elevation. Since the maximum load on the station will require 800 cubic feet per second, this means that the maximum velocity in the tail race will be 4 feet per second.

Transmission Line.

The transmission line is three miles long and is made up of six conductors connected in pairs so that these six form a single three-phase circuit. The wires are 0000 aluminum cable, supported on standard 6,600-volt, Locke porcelain insulators, which are fastened on "Lee" pins. The line is carried on wood poles of Michigan cedar, each 40 feet long, 23 inches in circumference at the top, 53 inches in circumference at the bottom, and set from 6 to 7.5 feet in the ground. The spacing is 180 to 200 feet. Two cross-arms, one long and one short, are placed on each pole and braced by special heavy strap-iron braces. The line is of massive construction. The cross-arms are 5 by 6 inches in cross-section, the lower arms being 7.5 feet in length and the upper ones 3.5 feet. The distance apart of the wires is from 2 to 3 feet. An overhead, stranded, galvanized, ground wire three-eighths inch in diameter is placed on each pole and is carried on an angle-iron support which projects three feet above the center line of the upper cross-arm. This ground wire is grounded at every fourth pole, the ground connection being the standard galvanized pipe driven into the ground with about a peck of rocksalt sunk around it near the surface of the earth.

The conducting cables are tied with No. 4 aluminum wire, a standard bridle tie being used. The line terminates at each end on a heavy strain frame, the pull of each conductor being taken by a 0.75-inch iron rod attached through a strain insulator to a heavy aluminum clamp fastened to the cable. From the strain frame each wire passes on an upward slope of 20 degrees through a three-foot length of six-inch tile pipe, set in the building wall, also placed at an angle of 20 degrees to the horizontal. The cables terminate inside the buildings on an inside frame, which has mounted on it the choke coils and lightning arresters. Owing to the shortness of the line, there are only two lightning arresters, one at either end, these being standard multigap devices made by the General Electric Company.

This transmission line was the first part of the entire installation which was built and was constructed some three years before completion of the rest of the plant. Under the contract with the City of Austin, power for use in construction of the dam and plant would be furnished free, and the transmission line has been in use for over three years, carrying current from the city out to the construction site. In this length of time no interruptions of service or troubles of any kind have been experienced.

The transmission line terminates in the steam power station now operated by the City of Austin, and only about six blocks from the heart of the city. There the 6,600-volt current passes into three step-down transformers, each of 1,500 kilowatts capacity. The secondary voltage is 2,300 volts, which is the same as the voltage generated in the steam plant, and of distribution throughout the city. The two plants are, therefore, enabled to operate in parallel and the present steam plant will be used as an auxiliary to assist the water-power plant in times of extremely low water.

The transformer connections are made in mesh, both primary and secondary. The transformers are oil-insulated and water-cooled, built by the Crocker-Wheeler Company.

Tests.

Complete efficiency and heat tests were made on the electrical apparatus before shipment from the factory. The generators, however, being vertical machines, the shop tests could not be made under the same conditions as those which existed after they were placed in the power house, with the shafts vertical. In the shop test, the generators were tested as horizontal machines, the shaft rotating in two horizontal bearings, and, therefore, the friction loss was considerably greater than that of the same machines set vertically with the weight of the rotor carried on ball thrust bearings. The results of the shop tests were, however, used to determine the efficiency of the rest of the equipment. The three generators showed the same efficiencies, these being as follows:

Load.	Efficiencies at power factors of 1.00	0.80
0.50	93.6	91.9
0.75	95.4	94.0
1.00	96.2	94.8
1.25	96.6	95.3

In order to make an efficiency test of the complete equipment a weir was built in the tail race, which was provided with a notch 3 feet in depth and 29 feet in length, so that with the full load of 1,800 kilowatts on one machine and full head of 65 feet, the quantity of water required, gave a height of about 33 inches over the crest of the weir. A six-hour test was conducted on each of the units. Calibrated instruments from the Electrical Testing Laboratories were used.

The total efficencies, from the gross energy in the water to the electrical energy delivered at the switchboard, varied but little among the three units, the maximum difference being not over 1.25 per cent. The average, over-all efficiency at full load was 83.5 per cent, which showed the average efficiency of the water wheels

to be 87 per cent. The load was practically non-inductive, being made up of iron-wire resistance coils submerged in shallow tanks, a continuous supply of water being delivered to the tanks to keep down the temperature. The actual resistance of these submerged wire coils was considerably less than the computed resistance, and on investigation, it was found that the cooling water was sufficiently impregnated with alkali and salts of various kinds to reduce its normal resistance considerably and it acts, in a measure, as an electrolyte. More than twice as much resistance was required to produce a proper load on the generators as the computations, based on available data concerning submerged resistances, first showed would be necessary.

The efficiencies of the step-down transformers at 100-per-cent power-factor were as follows:

Load.	Efficiency in Per Cent.
0.25	97.73
0.50	98.65
0.75	98.80
1.00	98.91
1.25	98.80
1.50	98.60

Lamar Lyndon, of New York City, was consulting engineer, and Frank S. Taylor was resident engineer.

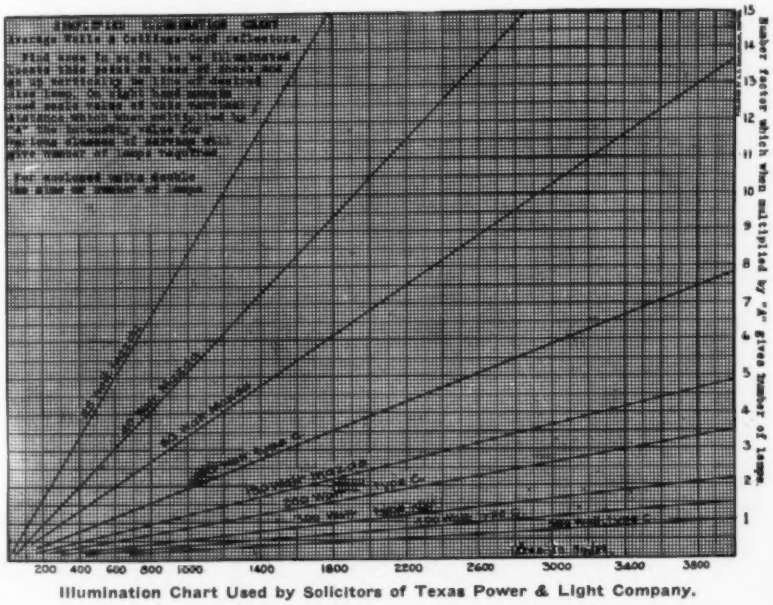
Commercial Practice
Management, Rates, New Business

Doherty Employees Dine Their Chief.

The proverbial family spirit of the organization of Henry L. Doherty & Company, public-utility operators at 60 Wall Street, New York City, was again shown on May 14, when Mr. Doherty was tendered a dinner at Davidson's in honor of his forty-fifth birthday by his male co-workers, numbering more than one hundred and representation was limited to the New York organization. Mr. Doherty, visibly affected by the demonstration of loyalty, praised his organization and outlined a plan to increase the contentment of his men.

As a birthday present the men gave Mr. Doherty a set of Elbert Hubbard's "Little Journeys to the Homes of Famous Authors" in levant binding and with a special dedicatory page in each volume. The "Sage of East Aurora" was a personal friend of Mr. Doherty and in returning thanks for the gift he voiced his grief over Mr. Hubbard's death in the *Lusitania* catastrophe.

The Doherty organization furnished excellent talent for the entertainment program, the chief feature being a sketch entitled "Wheels Within Wheels, or Acquiring a New Spoke," in which the characteristics of the three firm members, Mr. Doherty, Frank W. Frueauff and Charles T. Brown, were played upon by the author, William P. Troth, of the banking department.



Illumination Chart Used by Solicitors of Texas Power & Light Company.

Simplified Method for Calculating Illumination.

Methods of figuring illumination are ordinarily so technical that they are not understandable by the majority of contractors and hence little care, other than "rule of thumb" methods, is taken with the smaller illumination problems.

The accompanying chart can be easily and quickly employed to determine the proper number of lamps to use in lighting a given area. When used in connection with the table of average intensities given below any ordinary problem can be accurately solved. This chart and table are supplied to the solicitors of the Texas Power & Light Company, Dallas, Tex.

Attention should be given to spacing of units so as to secure uniform distribution. The lamp size should be chosen so as to obtain as nearly as possible a number of squares, in no case less than 10 feet on a side, one lamp being used in the center of each square.

In order to get the best results, lamps should be hung at distances above the plane to be lighted as indicated, *D* representing the distance between two lamps which in the case of the square arrangement will equal the side of a square.

Type of reflector	Height above plane
Extensive	0.5*D*
Intensive	0.8*D*
Focusing	1.3*D*
Concentrating	2 *D*

VALUES OF "A"—INTENSITIES IN FOOT-CANDLES RECOMMENDED FOR VARIOUS SERVICES.

Auditoriums	2.0
Ball Rooms	2.0
Banks—General	3.0
Banks—Desks	5.0
Bar Rooms	3.5
Barber Shops	4.0
Billiard Halls—Tables	6.0
Cafe	3.0
Church	2.0
Court Rooms	2.5
Drafting Room	8.0
Library—Reading Room	3.0
Offices—General	6.0
Postal Service	7.0
Pool Tables	6.0
Residences:	
Hall	0.7
Reception	1.0
Dining Room	1.5
Kitchen	2.0
Bed Room	1.5
Bath	2.0
Show Window	20.0
Stores:	
Clothing	3.0
Drug	3.0
Grocery	3.0
Hardware	3.0
Jewelry	5.0
Shoe	3.0
General Merchandise	3.0

Residential Load Characteristics.

An enterprising central station located within the north central states recently completed a survey of its residential business, the principal object of which was to obtain certain factors for its guidance in selecting suitable transformer capacity for such service; also to learn as much as possible of the general characteristics of residential business.

For this survey a certain feeder was selected, which supplied a residential section of the city consisting, with a very few exceptions, of residential business, such as lighting, appliances, etc.

This feeder was equipped at the switchboard of the company's substation with one General Electric curve-drawing wattmeter, one General Electric watt-hour meter and one curve-drawing ammeter, records being obtained from all of the above, once for each 24-hour period.

The period selected for this survey was arranged so as to coincide as nearly as possible with the billing period of the district served, so as to obtain the aggregate of all of the customers' meters, for comparison with the input to the feeder, as shown by the substation meter. A careful survey of the distributing system of this district was made in addition to the information obtained from the company's records, so as to obtain definite data, especially of the number and size of transformers connected.

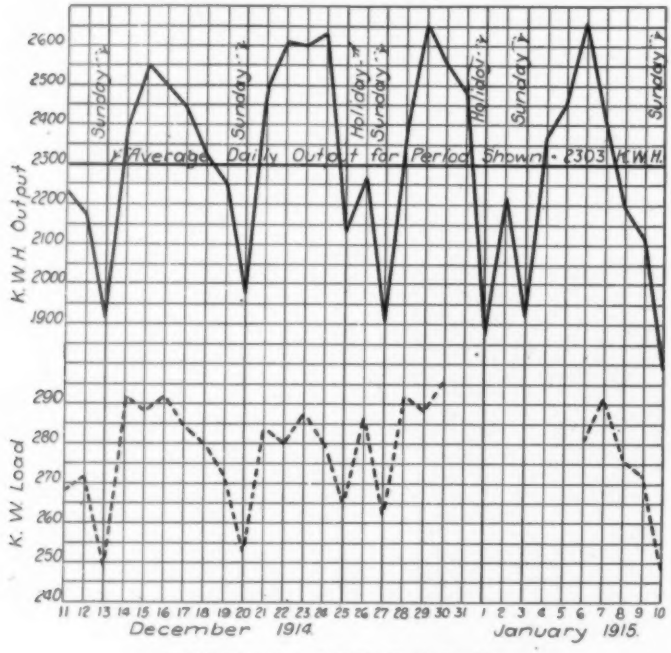
The center of distribution of this residential section is approximately one and one-half miles from the substation from which it receives its supply, and about one-half of this distance the transmission is made by 4/0 three-conductor underground cable, the remaining portion being aerial construction using No. 2 B. & S. wire.

The accompanying curves graphically show the daily kilowatt-hour input to this particular feeder; also the daily maximum demand as obtained by the curve-drawing wattmeter.

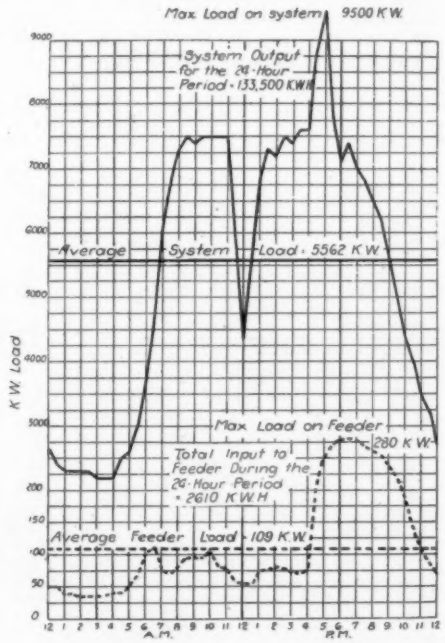
A further analysis by means of the curve-drawing ammeter for one 24-hour period, shows that the peak occurs at 6:00 p. m. and is sustained for approximately three-quarters of one hour, or until 6:45 p. m. Another interesting feature is a peak of considerable importance, occurring at 6:30 a. m. and lasting about one-half hour; this peak is approximately 40 per cent of the evening peak. This is clearly shown in the characteristic load curve for December, 1914, comparing this residential feeder load with the load on the entire system.

The following presents the most interesting features of the information obtained, as a result of this survey:

Number of residential customers served from this particular residential feeder	1,828
Kilowatt-hours input to feeder at substation	71,400
Kilowatt-hours input to feeder per customer	39
Kilowatt-hours as registered on customers' meters	50,827
Kilowatt-hours registration per customer	27.8
Total transformer capacity serving this district	585
Number of transformers	93
Average capacity per transformer (kilowatt)	6.3
Transformer capacity per customer served (watts)	320
Load-factor as per input meters (per cent)	32.5
Load-factor as per customers' meters (per cent)	23
Revenue for the coinciding billing period	$4,463.82
Revenue per customer	$ 2.44
Maximum demand at substation end of feeder (kilowatt)	296
Average demand per customer (watts)	150
Per cent of input energy to feeder recorded on customers' meters (per cent)	71



Total Output and Daily Peak Loads.


Max. Load on system = 9500 K.W.
System Output for the 24-Hour Period = 133,500 K.W.H.
Average System Load = 5562 K.W.
K.W. Load
Max. Load on Feeder = 280 K.W.
Total Input to Feeder During the 24-Hour Period = 2610 K.W.H.
Average Feeder Load = 109 K.W.
A.M.
P.M.

Characteristic Load Curves for December.

New York Edison Company's Artistic Lamp Exhibit.

An unusual exhibit of artistic electric table lamps was opened to the public in the Irving Place and Forty-second Street showrooms of the New York Edison Company on May 15. The collection will probably be on view for about 15 days. This is the first time that an effort has been made to get the products of a score or more of well known lamp makers in one exhibition.

From an artistic standpoint the collection is remarkable. There are hand-painted shades of silk and parchment, and excellent examples of work in art pottery and glass. The bases are of composition, metal, wood and pottery, and represent the designs of various periods. In addition to the table lamps, the exhibit also includes demonstrations of some of the newer methods of semidirect and indirect illumination.

Electrical Construction

ELECTRIC ELEVATORS, OPERATION AND MAINTENANCE.—I.

By A. C. Bender.

The electric elevator is continually finding favor with builders and owners of large office buildings and department stores, and in fact every department of elevator service. The principal reasons are low first cost and safety in comparison with hydraulic or steam lifts.

For a department store and office building, where a great number of persons are handled daily, it is the ideal car from the "safety-first" standpoint. Any one who has ridden on a hydraulic car may have noticed when the operator was making a stop it required a constant adjustment of his lever or rope to land his car even with the floor, and after same was done and a passenger was about to alight the car was suddenly raised or lowered from the landing, necessitating a quick move on the passenger's part. If that person is old or slow the danger is obvious. With the electric elevator this bad feature is entirely eliminated, because of its construction.

To the electrician taking charge of a large office building or department store where the equipment consists of electric elevators, his reputation as an electrician will greatly hinge on the elevator service. It is, so to speak, the barometer of his efficiency. It is up to him then to maintain his elevators in first-class condition at minimum cost, and his motto should be "Keep them running."

It is the intention of the writer to give his experiences with the principal types of elevators, their troubles, how located, with drawings and hints which will help upkeep. The electrician with even considerable electrical knowledge will feel a little anxious when called upon to take charge of such an equipment without previous experience, but if he has sufficient confidence in himself, and is reasonably careful, he will find it no difficult task to master.

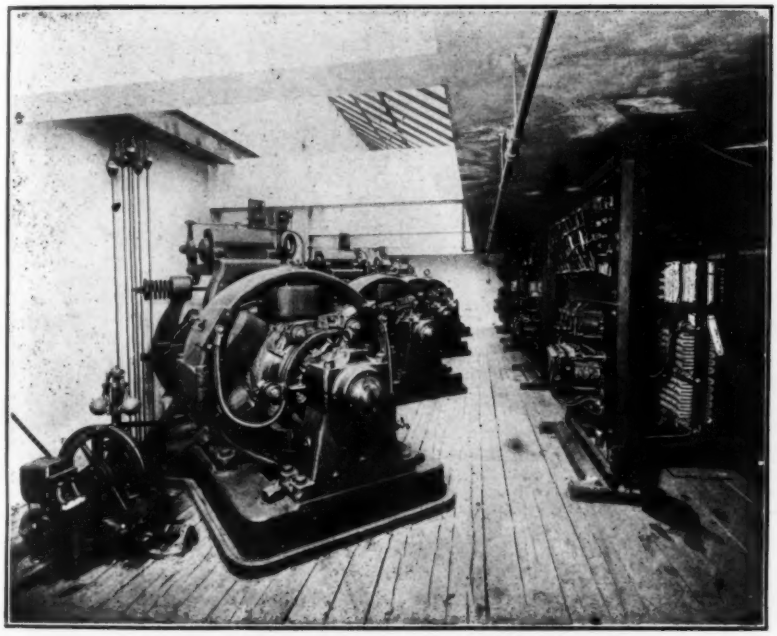


Fig. 1.—Typical Installation of Elevator Motors.

Direct-Connected Elevators.

Traction Elevators, One-to-One Type.—Traction elevators are the latest product in elevators and are without question a step forward in elevator design. We shall describe them first.

This type of machine has many advantages over the worm-gear machine, viz.: simplicity, absence of backlash, saving in cost of oil by eliminating leaky stuffing boxes, and smooth starting and stopping; in fact, they ride as easily as the hydraulic elevator when properly adjusted.

Because of low speed and high torque necessary the motor used is 30 to 40 per cent larger per horsepower; it is shunt-wound, multipolar, running about 63 revolutions per minute. The driving unit is set on a common base with the brake pulley mounted on one end, and the brake-release magnet or solenoid mounted directly above it (see Fig. 1). The cable drum is situated in the center and usually provided with six cables, which in place of fastening on drum, as is the practice on worm-gear machines, make a complete turn around the drum and then drop to a secondary sheave or drum, then to counterweights and car, respectively.

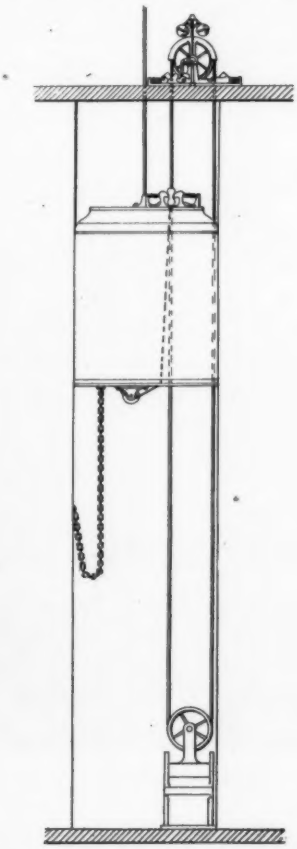


Fig. 2.—Showing Safety Device and Balancing Chain.

Overbalancing is generally resorted to, with equalizing chains that take care of

the weight of the cables as the location of the car changes (see Fig. 2). These chains are often the cause of considerable noise and rattle, and a simple remedy resorted to is lacing strong window sash line through each link.

Vibration is reduced to a minimum by the use of rubber or leather buffers. This is accomplished by having a spider on the shaft match a similar one on the cable drum, with washers interposed and held in position by tie bolts. Of late, leather has displaced rubber buffers, owing to the rapid deterioration of rubber when subjected to oil or grease, causing them to shrink and become loose.

The main bearings on the motor and secondary drum are of the self-oiling type with chains traveling on the shaft, immersed in oil, each bearing having a sight altitude glass. This makes a very efficient oiling system, requiring but little attention and maintenance and subsequent worry.

heavy coil springs, the pressure on them being increased or decreased, as the case requires, by setting up nuts on each end with a wrench (see A, Fig. 3) and adjustments are made at B by advancing or retarding the brake shoe to or from the pulley, as the case requires.

The release of the brake is effected by pull of the solenoid C, compressing the coil springs D when the elevator is running. Provisions are made at switch E to have part of the current shunted or by-passed through suitable resistance after the brake has operated and released, by the use of two carbon contacts shown operating by the push actions of rods F, this reducing the amount of current flowing in the solenoid after its operation, and eliminating overheating while the elevator is running.

Care must be taken when adjustments are made on the brake, and its importance can not be overestimated when one considers that the good operation and safety

switch E to open and close without slamming. The distance of the carbons at E should never exceed three-fourths inch separation when fully opened. A little practice will enable these to be set properly.

It is understood when these adjustments are made that the operator is running the car without passengers and stopping every two or three floors until final adjustments are completed, and car starts and stops smoothly.

Safety Devices.—The traction elevator has for safety many effective devices, some electrical, on the controller, acting automatically, and others operating mechanically.

Safety Governor.—The safety governor, generally located at the top of hatch or machine room when machines are overhead, is a ball governor similar to the type used on a hydraulic or steam elevator. It depends on centrifugal force acting on two freely revolving balls that

Fig. 3.—Brake Pulley and Springs.

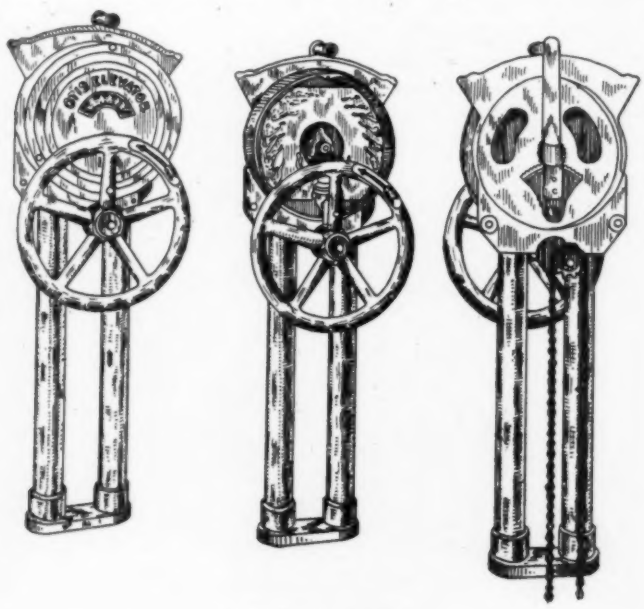


Fig. 4.—Car Controller.

Brake Operation.—The brake on the traction elevator, as on other types, depends on the dynamic brake action of the motor for slowing down and on the mechanical brake for holding.

The Dynamic Brake.—The dynamic brake used on this type of elevator depends for its action on the principle of all dynamic brakes, which is to short-circuit the motor armature through suitable resistance after the power is discontinued, this causing the motor to act as a dynamo and apply a counter electromotive force through the resistance; the effect is then a smooth, gradual slowing up, and the mechanical brake is finally applied.

The Mechanical Brake.—The mechanical brake is applied by the force of

of the car depend upon it. Looking at Fig. 3, it will be seen that there must be a relation between distance of pull at the solenoid C and the tension of the coil springs D; this distance at C can be set arbitrarily at three-eighths inch, when car is at rest. If when running the car, the brakes release without pounding and the brake shoes just clear, that is, they do not touch the pulley, and it is found the car slides more than eight or ten inches, tension should be given coil spring D by giving nuts A and A^1 a few turns in, on each side, and car tried again.

This process must continue until satisfactory results are obtained, then all locknuts made fast. It will now become necessary to readjust rods on shunt

raise and lower a predetermined distance when set for a specific speed, by compressing or releasing springs (see lower left corner of Fig. 1). An idler is used at the bottom with vertical guides in which a rope passes through and then around governor pulley, a counterweight retaining it taut. When the speed exceeds a given number of feet per minute the balls are raised, and actuate a cam by means of a link. This in turn short-circuits part of the field resistance of the motor, thereby increasing the field strength and decreasing the motor speed. If its speed is not then sufficiently decreased, the governor balls continue to rise until the second cam is brought into action, and it in turn trips an eccentric operated by two coil springs. This ec-

centric then bites in the loose cable and pulls out hitch cable underneath car, this then setting the dogs and cutting off power at the motor, by switch on car, by having opened potential switch. A handwheel is provided in the car, permitting the cutting off of power and setting the safety dogs, should an emergency arise. This handwheel is connected with rack and pinion to the same safety operated by the ball governor (see Fig. 4). Provisions are made in the car for releasing the safety dogs should they become set. This is accomplished with a special socket wrench provided by the manufacturer. A brass plate is removed from the center of the car floor, where a receptacle is found to engage a wrench. Before releasing the safety dogs it is necessary to release cams at the governor by striking each side with a hammer or other object, unless provided with a release lever. When this is done the governor cable becomes loose and is ready for taking up with wrench in car. The wrench is then placed in receptacle at center of car floor and turned in a right-hand direction. This action then winds up the slack cable on a small drum under the car floor. Before the winding up is fully completed, a slack-cable lug must be reinstated to a spring crab or container located on top of car (see Fig. 2). It is now ready for the final few turns of the wrench. This action will close the safety switch below the platform (see Fig. 8) and release the dogs.

The Up and Down Limit Switches.—The up and down limit switches prevent the car from dropping below or striking above a predetermined position. This is accomplished by a cam on the car striking a snap switch and breaking the current of the main potential switch, which in turn cuts off the source of power. This circuit should be traced in the wiring diagram, Fig. 8 The up and down automatic located on top of car operates by long cams located in the shaft at the proper points, and their use is to automatically effect a slowing up when the car is nearing the top or bottom of last landing. In this manner, irrespective of the position of the controller handle in the car, it is brought to a slow speed and final stop automatically. The switches for this automatic are inclosed in an iron case, and their construction is similar to a sign flasher, with cams mounted on one shaft and arranged to operate consecutively switches, cut in series with speed switches on controller board, thereby slowing down the motor.

Special socket wrenches are provided for this automatic and care must be taken when making adjustments that a mark is made at each cam before changing its location, so as to enable one to determine the distance moved from the original position. It is not often that resetting becomes necessary, as trouble may be found in a loose brake, causing a car to slide after automatic has acted, or controller may need cleaning to get proper dynamic-brake effect.

Otis Magnet Controller.

This controller is called type M. F. No. 4, and is the one largely used with traction-type machines. The controller is the heart of an electric elevator and on it depends in a large measure the successful operation of the car. Fig. 5 shows its general appearance.

At 1, Fig. 7, is shown the potential switch, where the main line current is carried to the board. In the same figure, 4 and 4 are the up and down reversing switches. Switches marked 3 are called the E. C. speed magnets and are in action after the reverse switch, building up speed in the same manner as a starting-box handle when moved to cut out resistance. Number 5 is called the V. A. magnet with double contact, and its function is cutting in field resistance to attain minimum field for high speed. Number 6 is called V magnet, with light arm, and is an auxiliary load device. Number 7 is caled V. A. magnet with single contact, and is a minimum-current shunt-field safety device; *i. e.*, should the field strength drop below a predetermined amount, this magnet will release its armature and open the circuit of po-

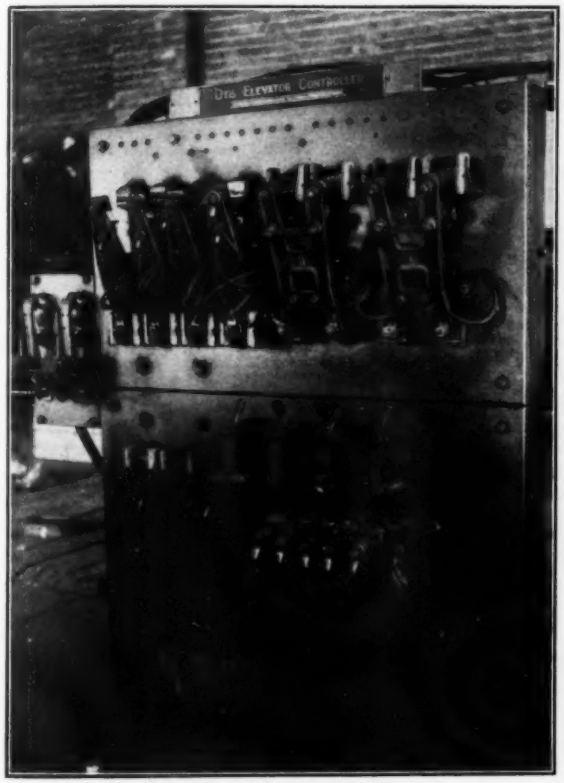


Fig. 5.—Front of Control Board.

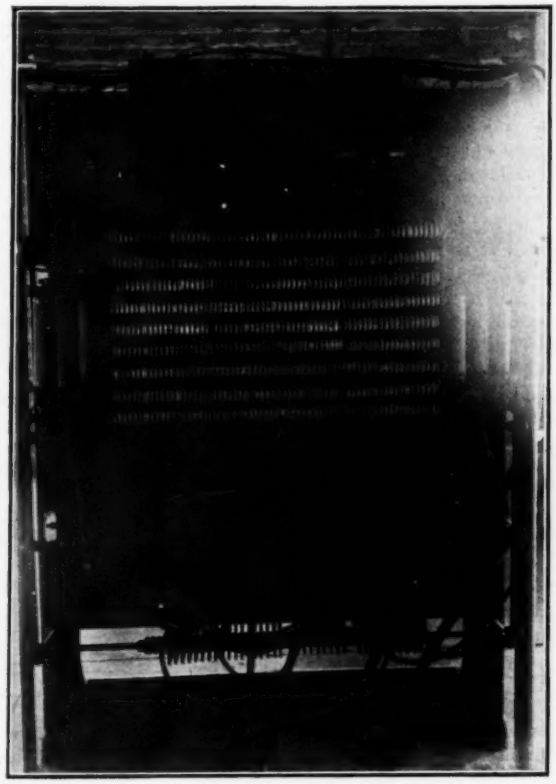


Fig. 6.—Back of Control Board.

tential switch 1, cutting off power and stopping the elevator. Number 8 is called the T. A. T. magnet with extra contacts and is the accelerating device for attaining high speed (see wiring diagram, Fig. 8).

Mounted in rear of board (see Figs. 6 and 7) are the lava resistance tubes (9) connected in series with magnet coils for cutting down current where necessary. Number 10 are the reversing-switch magnet yokes, number 11 speed magnet yokes, number 12 wire resistance for shunt motor field, number 13 cast-iron grids for armature resistance and by-pass resistance, and number 14 is the cast-iron base.

The wiring diagram (Fig. 8) is for the Otis M F. 4 B controller and is used with the one-to-one traction elevator. This diagram shows the rear view of the controller.

A is the main line switch and runs directly to board, connecting to fuses or circuit-breaker for protection, and from there to potential switch.

Running to the motor are wires (K, I, E, D), D and K feeding the shunt field, E and I the armature.

A and B are the reversing switches, or direction switches, as they are sometimes called, and carry the main current. Blow-out coils are used to decrease the arc.

The speed magnets (C, D, E, F) cut in more speed by cutting out resistance.

G, H, I, K are safety magnets and are needed for protective reasons. G is called the minimum-current shunt-field safety magnet and is so connected that if the shunt field opens or weakens to a set factor, the main current will be cut off and motor stopped.

H is the auxiliary load magnet, I excess potential safety magnet, K fast and slow-speed magnet, L is the potential switch and M the accelerating magnet.

Below the car-switch diagram will be seen a junction box. From this point underneath the car floor are suspended controlling cables that lead to a junction box located in center of hatch, and from this point they are run in conduit to their proper location, back of controller board and to the limit switches.

Looking at car-switch diagram it will be noted that the circuits are led to a point called the up-side switch and the down-side stop switch. They are also known as the automatics. These circuits are connected in series with the circuits of the car switch and stop the car automatically at the top and bottom landing.

A safety switch is shown in the car, to be opened when operator leaves car.

The switch on safety plank under car opens circuit on potential switch, when dogs are set by the handwheel or automatically.

Controlling Board Troubles.—To obtain best results from the controller, all contacts must be kept in good condition and sandpaper pulled through carbon and copper contacts, making a good seat and even contact. This should be done by pressing top of switch in by hand and pulling sandpaper through it. For precaution, main line switch should be pulled or safety knife switch found near potential switch opened, when all contacts are cleaned and in good shape. Nuts, bolts and locknuts should be examined and made tight where needed. This is important and will save lots of unnecessary trouble.

In many cases it will be found that switches do not draw in properly. This trouble is caused sometimes by having rear magnet stud or stop set too close or too far from magnet, causing plunger to strike without making proper contact or decreasing the pull by excess air gap. A set-screw is provided on the magnet yoke for adjusting this condition. By holding switch tight in position with set-screw loose, a place will be found for setting core after a few experiments. Should this trouble still exist, plungers must be removed and carefully cleaned of dust and grit and powdered graphite used to lubricate plunger and solenoid.

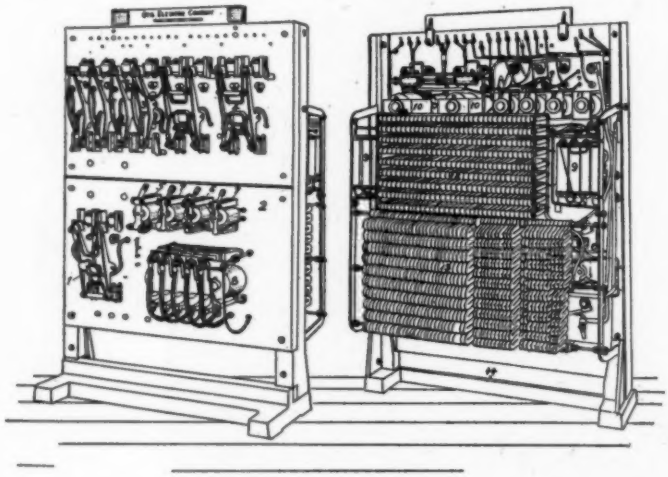


Fig. 7.—Diagram of Control Board.

We will assume that the electrician is called in case of trouble and finds that the elevator will run either way slowly but will not attain full speed. He should proceed as follows. On reaching controller board let operator run car without passengers up and down a few trips. If it is found on examination that reverse switches go in and make good contact then examine speed switches and accelerating magnets for loose contact or broken wire. If no trouble is evident there, look at the brake to see if same is releasing properly and, if by-pass switch is broken or fails to open. It is well then to examine motor for loose connection on brushes, etc. After all parts are carefully looked over and trouble still remains, the automatic on top of car must be examined for poor contact or loose connection and cam arm of automatic examined to see if same returns to neutral position with sufficient force to close all circuits. Controller box in car must now be looked at for broken contact finger, dirt, etc.

If after making this general survey, trouble is not found, we may suspect trouble with the controlling cable. As a rule two men are required to locate cable trouble, but if one man must work alone he can devise means for overcoming the handicap. As shown in Fig. 8, a junction box is situated in hatchway for testing and supporting cables, making it convenient for testing. By dropping down wire to top of car, connected in series with proper number of lamps to take care of line voltage, and using pipe for ground return, a good test line is made for testing wires in stack pipe, from junction box to controller. After a test is made from the junction box to the suspected wires on controller board, and, they are found O. K., the cables must be tested out from junction box in shaft to junction box under car, by putting a short-circuit on entire cable at terminals, and ringing out, or testing with an open test set in series with lamps. Same operation must take place from box under car, to car controller and wires leading to automatic on top of car. When defective or open wire is found, a number of spare wires are provided in each cable for just such contingencies. The defective wire is now removed at each terminal and spare wire substituted. After replacing all covers on boxes, etc., the car can now be tried.

We will now assume a somewhat different case of trouble. In this case it is found that the potential switch will not remain closed or will remain closed only when car is standing, or potential switch kicks out after elevator has attained maximum speed. For the first case, fuse behind controller board connected in

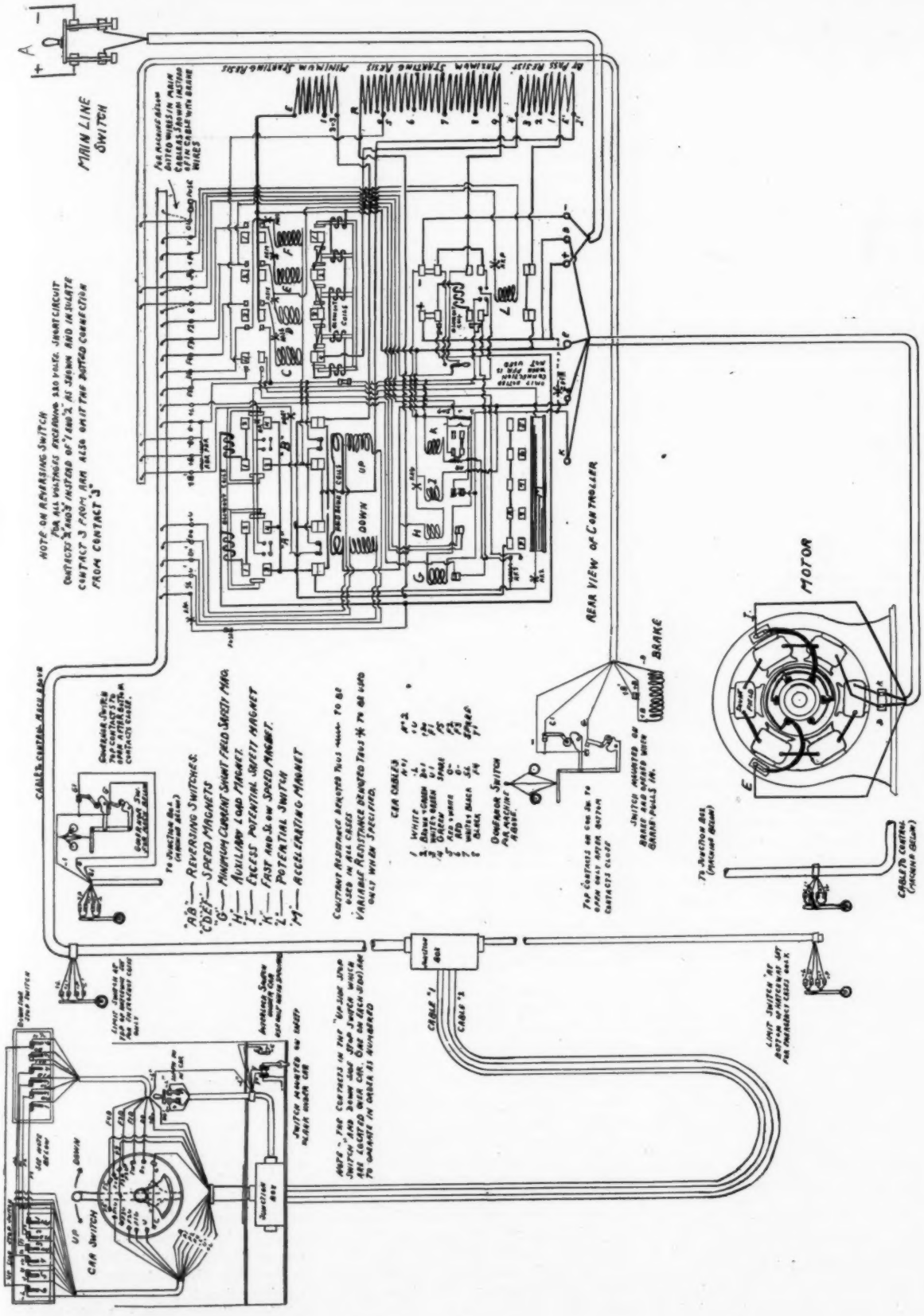


Fig. 8.—Wiring Diagram for Type MF No. 4 B Otis Magnet Controller.

series with potential switch must be examined to see if same is blown. If the fuse is found O. K., relays on board should be examined for bad contact or low voltage, which will exhibit itself there by weak pull. If this is not the trouble, limit switches both up and down must be examined for good contact or broken wire, etc., and same survey made on car automatic, looking also to see that the car safety switch is in position and that all other conditions are normal. We again can suspect our controller cable, testing with same method as explained before.

In our second case where potential switch will remain closed only when car is standing, we should examine our up and down limit switch and see when car is running if governor switch is causing our trouble by opening circuit after car has reached maximum speed. A further search must be made in junction boxes for short-circuit or grounds.

With our third case, where potential switch kicks out after elevator has attained maximum speed, our governor can be suspected, and its action caused by the poor operation of minimum-current shunt-field magnet, permitting excess speed and causing governor to respond.

We will now assume as our fourth case that elevator has suddenly stopped in the hatch and will move neither up nor down. We find on examination of controller board, fuses, etc., that everything is normal and all the controller switches operate and make good contact. We can now suspect our brake not releasing or may find our trouble is caused by the setting of the safety dogs on car. If this should be the case, inspection must be made of all conditions, to find if possible the cause.

In our fifth case we will assume that car will run up, but not down, or *vice versa.* We should now examine our controller for bad contact or loose connection or reverse switches, or defective brake action, defective automatic or defective car controller.

On all trouble of a similar nature a careful analysis must be made without unnecessary haste, thinking out all possible trouble before acting, and tracing out affected circuits in wiring diagram first. Locating trouble quickly of any nature will be greatly facilitated by making a complete study of every part of the elevator equipment and their relation to each other. In the next installment we will print instructions of one of the large elevator companies that apply not only to traction elevators but to drum type as well.

(To be continued.)

Electrical Fitter.

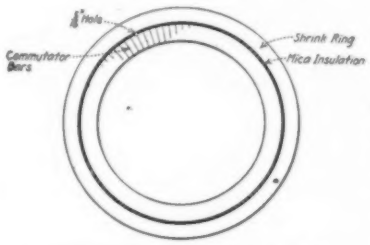
A contributor to an English electrical journal suggests the name "electrical fitter" in place of "wireman" for those workmen who make electrical installations. The term is analogous to "gas fitter" and "steam fitter," and is suggested as more comprehensive and more descriptive of the actual work done than "wireman." Apparently the term "electrical worker" has not come into general use in England.

Repairing a Commutator.

A method of making an emergency repair to a commutator is thus described by J. B. Crane in a recent issue of *Power:*

A 1,500-kilowatt, 600-volt, direct-current railway generator runs at 750 revolutions per minute, and the commutator bars are held in place by three shrink rings, which are separated from the bars by mica insulation.

A short-circuit developed between two of the bars, and investigation showed that it was directly under one of the shrink rings. To save the time and expense required to take off the shrink ring, a five-sixteenth-inch hole was bored between the two bars showing the short-circuit, it being necessary to drill nearly the whole



How Commutator Was Drilled.

depth of the shrink ring. After the short was cleared the hole was filled with a composition of mica and shellac, and the machine was put back in service after twelve hours' shutdown, and has since been operating and carrying full load without difficulty.

Testing the Air Gap of Induction Motors.

The air gap of an induction motor is small, from one-sixteenth to one-thirty-second inch in the finer cases, according to design. When inspected, even with a light, it is difficult to see thoroughly the condition. Sometimes dirt or lint or some foreign matter obstructs the view.

Take a hacksaw blade, fasten it to a handle and grind the teeth out; also grind the flat part according to size. By passing this convenient tool around between rotor and stator the exact condition of the air gap can be determined. It also clears out any dust or dirt and immediately detects any loose rotor bar or any other defect which may exist.

William T. Estlick.

Ohio Electrical Contractors Elect Officers.

The two-day session of the Ohio Electrical Contractors' Association, which was held in Cincinnati on May 12 and 13, was one of the busiest and most interesting which the organization has ever held. The first day was devoted to business and the formal program of the convention, President Charles Aull, of Cincinnati, presiding. Several papers of considerable interest were read, and discussion was general and interesting.

The most important business of the day was the election of new officers, which resulted as follows: President, W. H. Bothwell, Youngstown; vice-president, W. H. Harrington, Cleveland; secretary, Mr. Buchan, Cleveland; treasurer, W. G. Reuter, succeeding himself; delegate to national convention, Mr. Buchan.

The next annual convention will be held in May, 1916, at Youngstown. The semi-annual one-day meeting will be held at Columbus, in November.

The second morning was fully taken up by an automobile ride around the residence portion of the city, the party being taken to the Ohio River Launch Club's handsome quarters for lunch at noon. A trip down the river to Fernbank Dam on the *Margaret,* a handsome launch belonging to W. H. Hubbell, of the Cincinnati Fire Prevention Bureau, followed, taking most of the afternoon. A number of prominent electrical supply men attended the convention, bringing the attendance up to 40 or more, although the members in attendance numbered only about 25.

Among the Contractors.

The Sterling Electric Company, Minneapolis, Minn., has closed a contract with the city of Mankato for a White Way system, consisting of 61 posts. These are to be of the Cutter Broadway type, fitted with Novalux globes and 1,000-candlepower Laco nitrogen-filled lamps.

E. A. Braseth, Grand Forks, N. D., has the contract for the electrical work on the new Scandinavian Bank & Trust Building at Grand Forks, a complete conduit installation, requiring 30,000 feet of conduit, 90,000 feet of wire, and using 20 switchboards, including three metering panels, which control one or more rooms on a meter without changing any wires.

Mr. Braseth has just finished a conduit installation in the Grand Forks Court House, and also the following buildings: Walsh County Agricultural School, Park River, N. D.; Foston High and Graded School, Foston, Minn.; Skaren and Olson Building, Grand Forks; H. Bendeke Building, Grand Forks; Leslie Stinson Building, Grand Forks; E. J. Lander Building, Grand Forks.

National Association of Electrical Inspectors.

HUBERT S. WYNKOOP, President, 1574 Fiftieth Street, Brooklyn, N. Y.
WASHINGTON DEVEREUX, Vice-President, 131 South Fourth Street, Philadelphia, Pa.
WILLIAM LINCOLN SMITH, Secretary and Treasurer, Concord, Mass.
R. P. STRONG, Representative on Electrical Committee of National Fire Protection Association, 809 Hibernian Bank Building, New Orleans, La.

Executive Committee
J. C. FORSYTH, Chairman, 123 William Street, New York City.

SECTION REPRESENTATIVES:
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A. W. Hopkins, G. W. Perry, Western New England.
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Emil Anderson, Minneapolis, Minn.
F. G. Hartwell, Boston, Mass.
J. E. Latta, Chicago, Ill.
James B. McCarthy, Detroit, Mich.
H. G. Veit, Cleveland, O.

"LET THE CODE DECIDE."

Secretary's Message.

The Secretary is pleased to announce that the Executive Committee has been completed by the appointment by President Wynkoop as committeemen at large of Messrs. H. G. Veit, of Cleveland, O.; K. W. Adkins, of St. Louis, Mo.; Emil Anderson, of Minneapolis, Minn.

Messrs. A. Kempston and G. A. Cleary become representatives of the California Section, their constitution requiring that their representatives shall be the section president and secretary.

The Secretary had this week an interesting case of burn-out. In a high school basement a reinforced drop cord for a portable lamp hung from a fuseless ceiling rosette in the boiler room. On its end was a 40-watt Mazda lamp in a porcelain key socket. The cord was opened and separated to enter this socket.

About the cord just at the socket was twisted a length of ordinary flexible cord from which the insulation had largely worn off, and this was used to pull the drop lamp out of the way, the other end being twisted round a bare 1.5-inch hot-water return pipe for the boiler.

The flexible had sawed through the insulation in time and a current of 7 amperes by ammeter was flowing to ground over it, not enough to blow the 10-ampere fuse in the circuit.

This condition had evidently existed for some time as the janitor told me the wire was there when he came, and three months previously "a man came up to fix some fuses and he said it ought to be fixed, but I sort of thought the sparks hadn't hurt me and guessed he was looking for more work so I hadn't said anything about it."

Last week the boiler was shut down, and water drawn from the pipes. This reduced the conductivity, I presume; the current therefore in part passed from the pipe to metal lath and thence somewhere to some old disused bell wire, these all bunched together with still used clock wires in a closet under the basement stairs. The shutting down of the boiler allowed dampness to get in here and the current leaked from the bell wire to the grounded bell wire, charring the insulation and that on the clock wires in contact with it.

The clock circuit was operated by a 30-volt storage battery and when the charring had gone far enough this short-circuited, passing enough current to fuse the clock wire in one place and set the whole bundle on fire. The janitor found the flames breaking out into the stair well, put the hose on it and put it out. It happened at 10 a. m., with the school in session, but was controlled so promptly that no one in the building knew of it. It might, however, just as well have occurred at night, when the building might have been entirely destroyed, as it occurred in a very bad place.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Metal Cabinets on 600-Volt Grounded Circuit.

Question 298. The Code requires that metal switchboxes and cabinets be employed in connection with conduit work, and in many railway buildings 600-volt grounded circuits are frequently run in conduit. Bearing in mind the danger of shock or burn which would result from the silghtest slip or carelessness in operating such a switch, should this rule be enforced or should a box composed of inslulating material be accepted?

Answer 1 (N). This condition is a life hazard rather than a fire hazard and I do not think it was considered when the railway circuit rules were being drafted originally. I have not had many cases of it, in fact, but two.

In one of these I required an insulating box and bridged the conduit round it with a jumper. In the other I used a box in which opening the cover ruptured the circuit as in a combined switch and fuse box.

The matter is considered by implication in Bulletin No. 54 of the Bureau of Standards requiring all such live metal parts to be guarded and defining "guarded" as meaning "covered, shielded, fenced, inclosed or protected by means of metal or insulating covers, barrier rails or screens, mats or platforms, so as to remove the liability of dangerous contact or unsafe approach by persons or objects to a point of danger."

It brings us up squarely against a condition which we must face in view of the rapid progress of safety to workmen and compensation laws, the whole question being of additional precautions from this point of view over and above the requirements from the fire-risk standpoint.

Answer 2 (E). There is nothing within the Code that suggests the use of insulating material in installation of grounded trolley systems in car houses. I have treated each installation as an individual experience and have been guided in my suggestions by the special conditions.

Answer 3 (P). Under these condi-

tions I should make an exception and would permit the use of a box composed of insulating material. I hardly think it practical to so completely line a metal box as to cover the edges and if these are left exposed the hazard remains, although to a lessened degree.

Answer 4 (F and G). This question refers to liability of danger to the person operating the electrical equipment. The Code requires that only metal cabinets be used on conduit systems and they should be installed.

If protection to the person is considered necessary, the cabinet should be lined or covered with insulating material, such as slate, etc.

Answer 5 (H). There would seem to be good reason for requiring insulation of the switchboxes used on 600-volt grounded-circuit work in railway buildings.

Answer 6 (A). In all street-railway buildings the wires are run in iron conduit and this requires iron boxes and cabinets. If they become dangerous, that is for the company to take care of in the quickest possible time.

Answer 7 (O). There is no question as to the very serious life hazard which exists when switches, etc., in such a circuit are mounted in grounded metal boxes. Nevertheless they are required by the Code in case conduit is used. To avoid this it is best to keep the railway circuits out of buildings, if possible, or keep them out of conduit if they must be in buildings. If neither of these courses can be followed, it is then a matter for the inspector to decide whether or not it is his duty to enforce this requirement at the expense of endangering life. Personally I do not think this point was in mind when the railway rule was formulated, and believe exceptions should be made to require switches in these circuits to be inclosed in insulating boxes.

Answer 8 (B). If the rule is accepted by the department it should be enforced and if a department does not believe in enforcing a rule it should not be accepted.

Fusing Pilot Lights.

Question 299. Pilot-light receptacles continue to be placed in panelboard cabinets, although not to so great an extent as formerly. In order to serve their purpose they must be connected ahead of the circuit switches. What provision should be made for fusing them; or may they be attached directly to the busbars, considering that if they do break down they are still in a fireproof cabinet?

Answer 1 (N). If it is a specially constructed cabinet built in place, protect the receptacle with its own fuse—not over three amperes. If it is one of stock construction on the approved list, accept its construction as found.

Answer 2 (E). Pilot lights, to serve their purpose best, should be protected by their own fuses of proper size.

Answer 3 (P). In this territory we have not been requiring fuses for such pilot lights.

Answer 4 (F and G). All branch circuits should be protected by proper fuses. The fact that the lamp is used as a pilot in a cabinet does not alter this. A switch is not required, but fuse protection is absolutely necessary.

Answer 5 (H). Rule 23*b*, requiring fuses for every change in wire size, fully covers the point.

Answer 6 (O). If the pilot-light receptacle is a part of the panelboard it is covered by the label of the Laboratories. If it is installed by the contractor there is no reason why it should not be properly protected by fuses, as required by the Code.

Answer 7 (B). Rule 2*e* requires pilot lights as well as other apparatus on switchboards to be protected with approved fuses. There is no exemption made relative to pilot lights in connection with panelboards.

Circuits for 1,320 Watts.

Question 300. Why are circuits carrying 1,320 watts under Rule 23d limited to rubber-covered wires? Why is not slow-burning equally safe under conditions where it is allowed under Rule 26g? Or where the ceiling temperature is so high the inspector feels he must require it, and yet all conditions are suitable and indeed desirable for 1,320-watt circuits, must he nevertheless require 660-watt circuits?

Answer 1 (N). This question arises through a misapprehension. Rule 23*d* does *not* say rubber-covered wire; it says "equal in insulation to No. 14 approved rubber-covered wire." Now if you take the case under Rule 26*g*, then the slow-burning is assumed the equivalent and may be used, also if hot and dry.

In the last part of the question, if you have a high-temperature 1,000-watt type C Mazda lamp, you can't run rubber wire into it, and you certainly are not going to run two parallel circuits into the socket; of course you will use slow-burning, the condition being one later in origin than the rule.

Answer 2 (E). You will note that Rule 23*d* requires special permission. One reason for the restriction to rubber-covered wire was that such circuits would be largely run in conduit. Personally, if it should be open work, I feel that other forms of insulation would be preferable.

Answer 3 (P). Rule 23*d* was amended several years ago in response to a considerable demand which had arisen in connection with conduit and metal-molding work. In these cases rubber-covered wire is required. Presumably had the demand extended to slow-burning insulation, the Electrical Committee would also have taken it into consideration.

Answer 4 (F and G). We consider slow-burning insulation equivalent to rubber insulation when used in hot dry places.

Answer 5 (H). I see no reason for confining the wattage to 660 on slow-burning wire run open in places of high temperature.

Answer 6 (A). If the ceiling temperature is so high that the rubber insulation would fail, it seems to me any inspector would use horse sense and say to use slow-burning wire. The conditions as read in print are often far different when one strikes the real working conditions of a special case.

Answer 7 (O). I do not think the matter of slow-burning wire was in mind when the 1,320-watt-circuit rule was worded, as I recollect it. I think the words, "No. 14 B. & S. gauge approved rubber-covered wire" were used as a phrase with the idea of excluding flexible cords and fixture wire.

It would seem that in view of the increasing use of slow-burning wire of No. 14 gauge for fixtures containing type C Mazda lamps, there should be a rewording, to remove the *apparent* prohibition of 1,320 watts on such circuits.

Answer 8 (B). As this question does not ask for an interpretation of the rule referred to, but why something else is not permitted, we have no reply to offer.

Philippine Hydroelectric Plant.

At Lucban, Tayabas Province, Philippine Islands, a hydroelectric plant is being erected to supply light and power for the city. The project is financed by Filipino capital, but American machinery will be used. A Pelton water wheel and General Electric alternator will be installed in the plant.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

Great Western Power Company. The Railroad Commission rendered a decision May 10, 1915, under the terms of which the Great Western Power Company is given authority to purchase the properties of the United Light and Power Company. The United Light and Power Company operates electric and steam plants in the downtown sections of San Francisco and Oakland. The Great Western Power Company has formed a new corporation called the "Consolidated Electric Company," which is to hold the properties now owned by the United Light and Power Company. The stock of the Consolidated Electric Company will be owned by the Great Western Power Company. The representatives of the Great Western Power Company and of the United Light and Power Company claimed before the Commission that the value of the properties of the United Light and Power Company, which it is proposed to transfer to the Consolidated Electric Company, was $1,972,000. They asked that the Consolidated Electric Company be granted authority to issue against these properties its bonds in the sum of $2,593,000. In addition, the Great Western Power Company pledged itself to guarantee the entire issue of bonds of the Consolidated Electric Company.

Coast Counties Gas and Electric Company was granted authority to issue 1,000 shares of its six-per-cent, first preferred stock. The company proposed to sell the stock at not less than $90 per share. The decision of the Commission makes allowance for a five-per-cent commission, if found necessary.

The Southern California Edison Company. A supplemental order, approving an agreement between Southern California Edison Company and Los Angeles Trust and Savings Bank, trustee, has been issued, providing for the issue of $5,000,000 of five-year six-per-cent debentures. The Southern California Edison Company has received the approval of the Commission for the issue and sale of $2,500,000 of these debentures at the present time.

Pacific Gas and Electric Company was granted authority to issue 19,266 shares of the common stock of the par value of $100 per share.

MAINE.

Black Stream Electric Company was authorized to issue $10,000 of capital stock in 1,000 shares of common stock of the par value of $10 per share, to be sold at not less than par. Authority was also given to issue later six-per-cent bonds to the amount of $5,000, in denomination of $100 each, to be sold at not less than par.

The company asked for authority to issue its shares of common stock at less than par, "at not less than $9 per share." While this request was not urged by the company and the question of policy is not important in this case, the Commission takes the occasion to carefully outline its future policy in the matter.

The Commission is not in favor of authorizing new corporations to issue stock at less than par. The decision says: "The law of the State does not prohibit such stock from being issued and sold at less than par. It is content that stock so issued carry with it certain liabilities of the subscribers to such stock in case of failure of the corporation to meet its obligations to creditors. With this general legislative policy this commission has no concern officially. Nor will the Commission at this time attempt to fix any rule governing additional issues of capital stock by corporations already doing business, when new stockholders must share according to the number of their shares with those who previously acquired their holdings under different conditions. Another course may or may not be justifiable in such instances and will be consider when the exigency arises.

"But we see no reason why, when a new utility is being financed and all stockholders have an opportunity to come in on the same terms, the certificates of stock should not mean precisely what they say. In other words, should not speak the exact truth. No one is then deceived. No one is in doubt. The subscribing stockholder knows that he has discharged his entire liability, once for all time. A subsequent purchaser knows that the corporation has received full value for the certificate he purchases. The public knows that the corporation has received so much real value. The actual value of the assets of the utility thus keeps pace with the book value, so far as the business foresight and capacity of its promoters and managers can make it.

"On the other hand, if the stock is sold at less than par, the balance sheet of the corporation is likely to be misleading from the start. A bookkeeping liability in excess of actual value is created, and some fiction usually practiced to make the assets and liabilities balance. This may, or may not, be overcome in time by successful management and conservative practices in the payment of dividends.

"In the meantime the stock changes hands. Persons are induced to purchase on the supposition that the real assets are equal to the book assets. Then, if a question of rates arises and is adjusted, as it must be, on the actual value of the plant, such stockholders are likely to realize for the first time that their stock does not represent what it purports to represent. This practice has accounted in large measure for serious losses to innocent stockholders, and if persisted in now that rates and charges are subject to regulation, is likely to be even more disastrous.

"Nor can it be any real hardship to require subscribers to the capital stock of new utilities to pay in full for their stock, because they are, in fact, only partners in the enterprise, and if all pay alike they own the same respective portions of the entire plant."

MISSOURI.

Columbia Telephone Company. In an investigation to determine the reasonableness of the company's charges in Columbia, the Commission finds the fair present value of all property "used and useful by defendant company in the service of the public, considering said plant and each class of its property as a going concern, and taking into account the fact that said plant and each class of its said property is in successful operation, and including engineering, supervision and interest during construction, organization and general expenses, legal expenses, contingent expenses, insurance, general contractor's profit, promotion and other development expenses, working capital, and including all other elements of value, tangible and intangible, as used in the public service in furnishing telephone services, is as follows: (1)

City exchange, $105,000. (2) Rural lines, $42,000. (3) Toll lines, $35,000, making a total sum of $182,000. . . . ."

The Commission refused to state separately the allowances for tangible and intangible properties. The case of Appleton Water Works Company vs. Railroad Commission (154 Wis. 121) is cited, in which the court said: "The value of the plant and its business is an indivisible gross amount."

The company included an item in its estimate of reproduction cost new for "advertising and soliciting subscribers" and "cost of development." No evidence was given that such costs were actually incurred. The Commission says: "The 'reproduction method new' should only be used as a 'yardstick' or measure in trying to ascertain the 'fair present value' of the plant of defendant, used and useful, and now being appraised by the Commission. If the 'reproduction method new,' followed to the extreme, requires the adding of any items of expenditures which are, in fact, not actually incurred in the ordinary manner, then the method fails in its purpose, and is subject to criticism and abuse."

In regard to a reasonable return, the Commission held that at least 7.5 per cent should be allowed.

The Commission says the rates appear to be high, and can only be justified by reason of the well and expensively built plant and the high class of service rendered.

In regard to complainant's request that free service be rendered the city and public schools, the decision says: "It is not contended that such service is provided for in any franchise granted defendant company by the city. The Commission has no power to amend such a franchise at this time and to require such service, which would otherwise be a discrimination, and violative of the Public Service Commission Law. Courts and commissions seem to permit the furnishing of service to cities where the same is provided in the franchise as a part of the consideration for granting same. This Commission has not yet had occasion to pass upon that question one way or the other, and the same is left open for future determination. It is sufficient to say, we think, under the circumstances in this case, it would be a discrimination to require defendant to furnish the free service, as asked by complainants."

The defendant has in effect the following rules: "A deposit of three dollars shall be made with each order for service in the city exchange, which deposit will be credited on account of service in the concluding weeks of a full year." The Commission finds that this rule should be discontinued, and the company permitted to charge for three months in advance as a precedent to installation of service, and, thereafter, one month in advance.

"In Cole v. Ft. Scott & Nevada L. H. W. & P. Co., 1 Mo., P. S. C. 130, we held that an electric light and water company required to render service upon a meter basis, and where the amount of the bill or charge could not be determined in advance, might reasonably require a deposit or security in the nature of a guaranty for securing the collection for such service. We do not think the same reason exists with reference to the collection of rates for telephone service where such charges are known in advance.

"This Commission has no desire to deny to any telephone company the right to reasonably protect itself against loss, through the inability or unwillingness of its customers to pay. We see no reason why a charge for three months in advance for every telephone when installed, with charges monthly in advance thereafter, will not fairly and reasonably protect the company against loss. It is possible that rare and exceptional cases might occur when such a method of payment would not be adequate protection. As in the case of private enterprises, public utilities must expect to take some chances. All business involves some risk. We believe that if the company be allowed to charge three months in advance at the time of installing the telephone, and thereafter to collect for one month in advance, it will be fairly and reasonably protected. Such a course will do away with the discrimination complained of, and remove very much of the friction and ill feeling which has been engendered against defendant by the exacting of the three-dollar deposit."

The company classified all private residences where more than one boarder is kept as boarding and rooming houses, and applied a rate of $6 per annum higher to such residences than to residences without boarders. The Commission says it has searched in vain for the ruling of some other commission on this point. It concludes that the classification is unjust. The company charged this higher rate for an entire year, even if the boarder or roomer left within that time. This rule was not enforced in case of any other class of service, and it is found to be discriminatory and unjust.

In disposing of minor complaints in the case, the Commission holds that 50 cents a month additional for an extension telephone is the customary charge throughout the state for such service, and it is not disturbed. Complaint was made as to the location of telephones and the Commission held that it would not be justified in attempting to issue any general order regulating the location of instruments, "for the reason that the circumstances in each individual case might have a very material bearing as to the proper location of the telephone in the residence."

Complainants contended that subscribers should be permitted to own and furnish the extension telephones. "Here again the proof is all one way—that to insure good and efficient service, the telephone company should own all such parts of its instruments, and be held responsible for their proper upkeep and service condition."

NEW YORK—Second District.

Free Telephone Service. The Commission has taken steps to check the use of free telephones and other service, including that of pay stations, contrary to telephone tariffs.

In many places free telephones have been given to local officials and persons of prominence; in some places entire exchanges for giving free service in violation of law, and pay stations were shown to be giving local service without charge. This has resulted not only in violation of the law against free telephones, but in discrimination.

The Utica Gas and Electric Company was authorized to issue $350,000 five-per-cent, 50-year refunding and extension-mortgage gold bonds, to be sold at not less than 95, to be used to take up short-term notes now outstanding.

OHIO.

The Athens Electric Company was authorized to purchase the electric light plant and distributing system owned and operated in Athens by Francke C. Elliott. The company was also authorized to issue its common capital stock of the total par value of $75,000, and its three-year, seven-per-cent notes of the total principal sum of $75,000. Of the proceeds $25,000 from the capital stock and all of the notes are to be delivered in payment of the purchase price of the property. The remaining $50,000 arising from the sale of the capital stock, at not less than par, will be expended for extensions and improvements to the Athens Company's plant.

The Sandusky Gas and Electric Company was authorized to issue its first-refunding-and-improvement-mortgage five-per-cent gold bonds, of the total principal sum of $750,000. The bonds, to the amount of $500,000, principal sum, will be exchanged for an equal amount of the company's present outstanding mortgage bonds. The proceeds from the sale of the remaining $250,000, at not less than 87.5 will be used to reimburse the company for money expended in constructing additions and exten-

sions, and to finance further construction and improvement.

The Defiance Gas and Electric Company was authorized to issue its common capital stock of the total par value of $97,600, and its first-mortgage five-per-cent gold bonds of the total principal sum of $175,000. The proceeds will be used in payment of the purchase price of the properties of the Valley Light and Power Company and of the Auglaize Power Company, and for additions, extensions and improvements.

PENNSYLVANIA.

Peoples Natural Gas Company. A joint petition was filed by the Peoples Natural Gas Company and the Borough of Juniata for a certificate of public convenience approving a franchise ordinance. Franchise rights and privileges are granted the company "for the purpose of supplying natural or manufactured gas for fuel and lighting purposes" for a term of 40 years. The Altoona Gas Light and Fuel Company, a company supplying artificial gas in the Borough, entered a protest. The protestant urges that it is entitled to protection from competition. The Commission says: "Counsel for the protestant company cites a large number of decisions in support of the contention that the Commission should sustain this objection, but apparently none of them, nor any others we can find, go so far as to say that an artificial gas company should be protected in its field from the competition of a natural gas company. They all deal with the subject from the basis of a similar commodity or the rendering of like service by two public service corporations."

At the hearing expert testimony stated that the price in Juniata of artificial and natural gas would be about six to one, taking into consideration both quality and price.

"No company has the right to expect a Commission to protect it against the competition of a product which can be supplied at less than one-half of the cost of another product and answer the same purposes.

"This Commission cannot but have in mind the question of competition insofar as modern and more advantageous services are concerned, at a less cost, and if one company, by reason of its superior advantages, gives to the public a service as good as the existing utility, at very much lower rates, the interests of the public should prevail."

The ordinance, granted the applicant natural gas company, provided that upon diminution or failure in the volume of natural gas the "Peoples Natural Gas Company, its successors or assigns, may then use its pipe lines and other appliances in the Borough for the distribution and sale of manufactured gas." The Altoona company, referring to this provision of the franchise, further urged that the Commission should not approve a franchise granting rights which the company has no authority to receive or exercise. The attorney for the applicant admitted that the company, as now constituted, does not claim the right to distribute artificial gas. The decision says: "The municipality has no right to authorize this company to supply manufactured gas, nor does the company have the right to become a means for the passing on of a franchise for that purpose from the municipality to some other company. It is apparent the features of the ordinance relating to the manufacture, selling, distributing or otherwise dealing in artificial gas, are void, and the only valid portions are the assent of the municipality and those conditions which relate to the manner of constructing the plant proposed." In this connection a citation is given from City of Pittsburgh, 115 Pa. State, page 4, to the effect that "one section of an ordinance may be declared reasonable and valid, while another section of the same ordinance may be pronounced unreasonable and void."

Convention of Oklahoma Utility Men.

The fourth annual convention of the Oklahoma Gas, Electric and Street Railway Association was held at the Lee Huckins Hotel, Oklahoma City, on May 12 to 14. About eighty members were in attendance, the largest number that has been present at a convention of the association since its organization four years ago.

Mayor E. Overholser delivered the address of welcome, to which a response was made by George W. Knox, general manager of the Oklahoma Railway company, of Oklahoma City. President Knox of the association then delivered the annual presidential address, which was devoted principally to questions of public policy. He pointed out that the excessive amount of utility regulation was due largely to the former short-sighted policies of utility companies and urged that they take the public frankly into their confidence when utility problems are up for community consideration.

J. J. Johnson, assistant general manager of the Oklahoma Railway Company, delivered an address on "The Jitney Situation," during which he gave a complete digest of this form of transportation competition throughout the entire country and told of the particular experiences encountered in Oklahoma City. A. L. Mullergren, of Oklahoma City, read a paper on "The Modern Generating Station."

On the second day of the convention W. T. Dibbens, of Guthrie, read a paper on the natural-gas supply of Oklahoma. This shows no indication of being exhausted, and it is probable that that state will be served with this fuel for many years to come. The present rate of 25 cents a 1,000 feet does not yield a fair return on the money invested. The producing companies are selling service more than gas and the cost of this service is increasing.

R. W. Stinson and Homer Livergood, seniors in the University of Oklahoma, at Norman, gave the results of an analysis which they had made of the gas and electric utility rates in the state. E E. Hunter read a paper on "Relative Values of Coal, Oil and Gas as Fuel for the Production of Electric Power."

Officers for the association for the ensuing year were elected on Friday morning, as follows:

President, W. J. Dibbens, president of the Guthrie Gas Light, Fuel & Improvement Company, Guthrie.

First vice-president, Hugh J. Cooper, commissioner of public utilities, Weatherford.

Second vice-president C. H. Kretz, manager of the Okmulgee Ice & Light Company, Okmulgee.

Secretary and treasurer (re-elected), Harold V. Bozell, director of the School of Engineering, University of Oklahoma, Norman.

J. J. Johnson, assistant general manager of the Oklahoma Railway Company, Oklahoma City, and Fred W. Insull, president of the Public Service Company of Oklahoma, Oklahoma City, were also elected to the board of directors.

Noel R. Gascho, of Alva, and Galen Crow, of Oklahoma City, read papers at the last session.

National Association of Manufacturers' Convention.

The twentieth annual convention of the National Association of Manufacturers will be held at the Waldrof-Astoria Hotel, New York, N. Y., May 25 and 26. Former-president William Howard Taft will deliver an address entitled "The Clayton Act and Other Things." Senator Warren G. Harding, of Ohio, James A. Emery, of the National Council for Industrial Defense, Walter Drew, of the National Erectors' Association, Dr. Eugene L. Fisk, M. W. Alexander and Arthur D. Little will address the meeting. There will be a general discussion of several topics, and reports will be presented on fire and accident prevention, union label, immigration, uniform state laws, trademarks and copyrights, and industrial betterment.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 37.

Two sheets of tin foil each 10 inches square are separated by a sheet of insulating paper. The sheets of tin foil and paper are each 0.002 inch thick. The specific inductive capacity of the paper is 3.

Find (*a*) the electrostatic capacity of the condenser formed by the tin foil and paper; (*b*) the electrostatic charge on the tin foil when a direct emf. of 100 volts is impressed between the two sheets of tin foil; (*c*) the energy of the electrostatic field under the conditions of Question (*b*); (*d*) the current flowing from one sheet of tin foil to the other when the impressed emf. is increased uniformly from zero to 100 volts in one second. (*e*) If a condenser of one microfarad capacity is to be constructed of tin foil and paper of the thickness stated above, what is the minimum volume which it may occupy, neglecting the space required for end connections and overhanging insulation?

SOLUTION OF PROBLEM 37.

When an emf. is impressed between two conducting plates which are separated by an insulating material, the two plates are drawn together by a mechanical force. This force is attributed to an electric charge distributed over the surface of the plates; the charge on the plate attached to the positive terminal of the source of emf. is called a positive charge and the charge on the plate attached to the negative terminal of the source of emf. is called a negative charge. Experiments have shown that a moving electric charge produces the same effect as an electric current and that the positive charge in any system always equals the negative charge. It may also be shown that the magnitude of either charge is directly proportional to the voltage impressed between the plates.

The electric charge (Q) then equals a constant (C) times the voltage (V) impressed between the plates. The combination of conducting plates and insulating separation is called a condenser and the constant (C) is called the electrostatic capacity of the condenser.

When the charge (Q) is measured in coulombs and the voltage (V) in volts, the capacity (C) is measured in farads. The relation between coulombs, farads and volts is then given by

[48] $Q=CV$ coulombs.

The capacity of two parallel plates separated by an insulating material is given by

[49] $C=Ka/(d4.45\times10^{13})$ farads.

Where K is the specific inductive capacity of the insulating material, a is the area of each plate in square inches, and d is the distance between the two plates in inches.

Answer to Question a.

Since the area of each plate is 10×10 or 100 square inches and the distance between the plates or the thickness of the paper is 0.002 inch, the capacity of the condenser by [49] is

$C=3\times100/(0.002\times4.45\times10^{13})=3.37\times10^{-9}$ farad.

Answer to Question b.

The voltage between the two sheets of tin foil being 100 volts, the charge on each sheet of tin foil by [48] is

$Q=3.37\times10^{-9}\times100=3.37\times10^{-7}$ coulomb.

Answer to Question c.

When an emf. is impressed between the terminals of a condenser the condenser absorbs energy. If the impressed emf. is now removed this energy remains in the condenser, since the charges produced by the impressed emf. cannot escape. The energy stored in a condenser in this manner is given by [50]

$$W=CV^2/2 \text{ joules.}$$

A joule is a unit of energy equal to 0.738 foot-pound.

Under the conditions of Question (*b*) the energy stored in the condenser by [50] is

$W=3.37\times10^{-9}\times100^2/2=1.68\times10^{-4}$ joule.

Answer to Question d.

Although no current will flow through a perfect insulating material when the impressed emf. is constant, current will flow if the impressed emf. varies. If the impressed emf. varies at a rate of V/t volts per second, the current flowing in the insulating material is given by [51]

$$i=CV/t \text{ amperes.}$$

The current in this case by [51] will be

$i=3.37\times10^{-9}\times100=3.37\times10^{-7}$ amperes.

Answer to Question e.

From [49] it will be seen that the capacity of a condenser containing a given insulating material of definite thickness is proportional to the area of the plates. The capacity of a condenser may then be increased by connecting a large number of plates in parallel, thus obtaining the same effect as one large positive and one large negative plate. Such a condenser may be constructed of alternate sheets of tin foil and paper, every other sheet of tin foil being connected to the positive terminal and the remaining sheets to the negative terminal.

The capacity of such a condenser is given by multiplying the capacity of one condenser (as given by [49]) by n, the number of parallel condensers. Then $C=Kan/(d4.45\times10^{13})$ and for a given capacity

$$a=4.45\times10^{13}Cd/Kn$$

In a condenser consisting of alternate sheets of tin foil and paper of equal thickness the total thickness will be $(2n+1)d$, where n equals the number of parallel condensers and d equals the thickness of the tin foil or paper. The volume (v) of the condenser will then equal the area times the thickness or

$$v=(4.45\times10^{13}Cd/Kn)(2n+1)d$$
$$=4.45\times10^{13}Cd^2(2+1/n)/K$$

The volume is obviously a minimum when $1/n$ equals zero or n equals infinity. That is to say, the greater the number of sheets of tin foil the smaller the volume for a given capacity.

Substituting for C one microfarad, or 10^{-6} farad, the smallest possible volume must be

$v=4.45\times10^{13}\times10^{-6}(0.002)^2\times2/3=11.87$ cubic inches.

The maximum volume would be required when there was only one positive and one negative plate. The volume would then be

$v=4.45\times10^{13}\times10^{-6}(0.002)^2\times3/3=17.80$ cubic inches.

The area of each plate would be

$a=4.45\times10^{13}\times10^{-6}\times(0.002)/3=2,960$ square inches, or 54.5 inches square.

A condenser of these dimensions would be inconvenient but if n is made 100 the volume would only be

$v=4.45\times10^{13}\times10^{-6}(0.002)^2\times2.01/3=11.93$ cubic inches,

and the area of each sheet of tin foil would be

$a=4.45\times10^{13}\times10^{-6}\times(0.002)/(3\times100)=$ 29.60 square inches, or 5.45 inches square.

The total thickness of tin foil and paper would be $(2\times100+1)(0.002)=0.402$ inches. The dimensions of this condenser would then be roughly 5.5 by 5.5 by 0.4 inches and would be of convenient size for most purposes. The difficulty of constructing a condenser of one farad capacity may be realized by examining the above results since such a condenser would require one million of the above units and if packed together in the form of a cube each side of the cube would be about 19 feet in length.

ALTERNATING CURRENTS.

Problem 87.

A 1,500-kilovolt-ampere, 25-cycle, 13,200-volt synchronous generator delivers power over a transmission line and through step-down transformers to a six-phase, 1,000-kilowatt, 600-volt rotary converter. The armature windings of the generator are connected in star and have an effective resistance of 2.83 ohms between terminals. The resistance of the field circuit is 0.802 ohm.

GENERATOR CHARACTERISTICS.

Field Current, Amperes.	Terminal Voltage on Open Circuit.	Terminal Voltage I_a=66, $P.F.$=0.	Core Loss on Open Circuit, Kilowatts.
50	8,760	.....	10.5
80	12,950	.....	23.2
110	15,500	10,700	35.6
140	17,200	13,200	47.1
180	18,800	15,500	....

The friction and windage loss is 11.2 kilowatts. The transmission line is 10 miles long and consists of No. 3 wires equally spaced two feet apart. The resistance and reactance of this line at 25 cycles are 1.082 and 0.283 ohms per conductor per mile.

Each transformer has a ratio of transformation of 13,200:425 volts. With the low-tension winding short-circuited and with 1,120 volts impressed on the high-tension winding the current is 25.1 amperes and the power is 3,060 watts. The core loss at the rated voltage is 2,120 watts.

The rotary delivers 900 kilowatts at 600 volts and is operating at a power-factor of 0.85 and an assumed efficiency of 94 per cent. (*a*) How should the transformers be connected? (*b*) What is the line voltage where the transmission line enters the substation? (*c*) What is the line voltage at the generating station? (*d*) What is the necessary field excitation of the generator? (*e*) What is the combined efficiency of the generator, line and transformers?

The effect of the line capacity is too small to consider.

Condensers of a few microfarads or fractional microfarad capacity are used in connection with telephone circuits, in wireless-telegraph stations and in shunt with any current-opening device in which it is necessary to reduce arcing.

SOLUTION OF PROBLEM 87.

Answer to Question a.

Since the transformers are wound for a high-tension voltage equal to the line voltage of the transmission line, they should be connected in delta on this side. The phase voltage of a six-phase, 600-volt converter is

$$E_c=(600 \sin \pi/6)/\sqrt{2}$$
$$=212 \text{ volts.}$$

This is the voltage between adjacent slip rings. The voltage between alternate slip rings, *i. e.*, the three-phase voltage, is

$$E_3=(600 \sin \pi/3)/\sqrt{2}$$
$$=368 \text{ volts.}$$

The voltage between diametrical taps, *i. e.*, the single-phase voltage, is

$$E_1=(600 \sin \pi/2)/\sqrt{2}$$
$$=424 \text{ volts.}$$

This latter voltage is the same as the low-tension voltage of the transformers. Thus, on this side, the transformers should be connected through the slip rings to diametrical points of the rotary winding. This is much the same as the double-star connection.

Answer to Question b.

The power delivered to the rotary by the transformers equals the output divided by the assumed efficiency and is

$$P=900/0.94$$
$$=958 \text{ kilowatts.}$$

The volt-amperes delivered by each transformer are given by

$$VI=958{,}000/(0.85\times3).$$

Each of the three transformers delivers one-third of the total volt-amperes.

$$VI=376{,}000.$$

The drop in the armature of the rotary is small and it is quite customary to neglect it in problems like this. V is thus 424 volts for a terminal voltage of 600 volts on the direct-current side. The current delivered by the transformer is

$$I=376{,}000/424$$
$$=887 \text{ amperes.}$$

In order to find the voltage on the high-tension side of the transformers we must first compute the equivalent resistance and reactance of each transformer.

By [4a] $R_1=3{,}060/25.1^2$
$=4.85$ ohms.

By [3a] $Z_1=1{,}120/25.1$
$=44.6$ ohms.

By [5a] $X_1=\sqrt{44.6^2-4.85^2}$
$=44.3$ ohms.

The vector diagram used in finding the high-tension voltage is given in Fig. 39a. The high-tension current is

$$I_1=887\times425/13{,}200$$
$$=28.6 \text{ amperes.}$$

The low-tension voltage, V_2, referred to the high-tension side is aV_2.

$$aV_2=424\times13{,}200/425$$
$$=13{,}170 \text{ volts.}$$

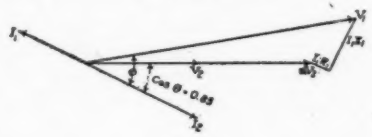


Fig. 39a.

If we turn the diagram so that I_2 lies along the horizontal axis, the horizontal and vertical components of V_1 are by [19a]

$$(V_1)_h=13{,}170\times0.85+28.6\times4.85$$
$$=11{,}200+139$$
$$=11{,}340$$
$$(V_1)_v=13{,}170\times0.526+28.6\times44.3$$
$$=6{,}930+1{,}270$$
$$=8{,}200.$$

By [20a] $V_1=\sqrt{11{,}340^2+8{,}200^2}$
$=14{,}000$ volts.

Since the transformers are connected in delta this is the line voltage at the substation.

Answer to Question c.

A common method of calculating the voltage at the other end of a transmission line is to use the voltage from line to neutral, *i. e.*, the line voltage divided by $\sqrt{3}$, the line current and the resistance and reactance of one conductor. In Fig. 40a the line current, I, equals $28.6\sqrt{3}$, since the transformers are connected in delta on this side. See formula [29a].

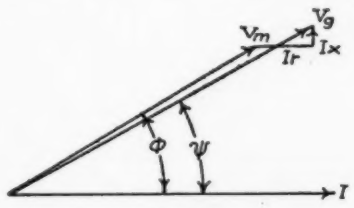


Fig. 40a.

The voltage from line to neutral, V_m, equals $14{,}000/\sqrt{3}$. See formula [30a]. The angle, ϕ, between the line current and the voltage from line to neutral, is the same as the angle, ϕ, in Fig. 39a, between the current in the transformer and the voltage across it on the high-tension side. The cosine of either angle is the power-factor at which the transmission line delivers power to the transformers.

$$I=28.6\sqrt{3}$$
$$=49.6$$
$$V_m=14{,}000/\sqrt{3}$$

$$=8,080$$

By [21a] $\cos\phi=11,340/14,000$
$=0.81$
$\sin\phi=0.586.$

The horizontal and vertical components of V_z are by [19a]

$(V_z)_h=8,080\times0.81+49.6\times10.82$
$=7,080$
$(V_z)_v=8,080\times0.586+49.6\times2.83$
$=4,875$

By [20a] $V_z=\sqrt{7,080^2+4,875^2}$
$=8,600$ volts.

The line voltage at the generating station is

$V_l=8,600\sqrt{3}$
$=14,900$ volts.

Answer to Question d.

The field excitation of the generator should be calculated by the method recommended by the American Institute of Electrical Engineers. This was explained in Problem 69.

From the generator characteristics we see that the synchronous impedance drop between terminals is 4,000 volts for a terminal voltage of 13,200 volts and 3,-

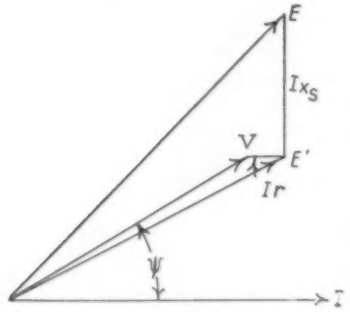


Fig. 41a.

300 volts for a terminal voltage of 15,500 volts. An approximate value of the drop for a terminal voltage of 14,900 volts would be

$4,000-(4,000-3,300)\times(14,900-13,200)/(15,500-13,200)$
$=3,480$ volts.

The synchronous impedance per phase is

$x_s=3,480/66\sqrt{3}$
$=30.4$ ohms.

Since the armature windings are connected in star, the effective resistance per phase is

$r=2.83/2$
$=1.42$ ohms.

The vector diagram used in calculating the field excitation of the generator is given in Fig. 41a. The phase current, I, is of course equal to the line current, I in Fig. 40a, since the generator is star-connected. The phase voltage, V, is the voltage from line to neutral and is the same as V_z in Fig. 40a. The angle, ψ, between the phase current and the phase voltage, is the same in both figures.

From Fig. 40a.

$\cos\psi=7,080/8,600$
$=0.823$

$\sin\psi=4,875/8,600$
$=0.567$
$V=14,900/\sqrt{3}$
$=8,600$

The horizontal and vertical components of the excitation voltage, E, are

By [19a] $E_h=8,600\times0.823+49.6\times1.42$
$=7,150$
$E_v=8,600\times0.567+49.6\times30.4$
$=6,390$

By [20a] $E=\sqrt{7,150^2+6,390^2}$
$=9,590$

The corresponding line voltage is $9,590\sqrt{3}=16,600$ volts. From the characteristic data the necessary field current is

$I_f=110+(140-110)\times(16,600-15,500)/(17,200-15,500)$
$=129$ amperes.

DIRECT CURRENTS.

Problem 38.

A lead-covered single-conductor cable is made of a No. 4 copper wire surrounded by a layer of rubber 0.25 inch thick, which is in turn surrounded by a lead sheath. The specific inductive capacity of the rubber is 3.5. (*a*) What is the electrostatic capacity of this cable per mile? (*b*) If a direct emf. of 10,000 volts is impressed between the wire and the sheath and the resistance of the rubber is assumed infinite, what is the potential drop between the copper wire and a point in the rubber 0.01 inch from the wire? (*c*) Under the conditions of Question (*b*) what is the potential drop between the lead sheath and a point in the rubber 0.01 inch from the sheath? (*d*) Under the conditions of Question (*b*) what is the potential drop between the copper wire and a point midway between the wire and the sheath? (*e*) If a layer of guttapercha (specific inductive capacity equals 4.5) is substituted for the outer half of the rubber, giving an insulation consisting of an inner layer of rubber (0.125 inch thick) surrounded by a layer of guttapercha (0.125 inch thick), what is the potential drop in the rubber and the guttapercha when a direct emf. of 10,000 volts is impressed between the wire and the sheath?

This problem illustrates the principle of graded insulation in electric cables.

ALTERNATING CURRENTS.

Problem 88.

A three-phase transmission line 10 miles long consists of 250,000-circular-mil cables equally spaced two feet apart. The resistance and reactance of this line at 25 cycles are 0.228 and 0.244 ohm per conductor per mile. A constant induction-motor load taking 5,500 kilowatts at 0.916 power-factor and with a line voltage of 13,200 volts is at the end of this line. The generating station has a full-load capacity of 325 amperes per conductor. A synchronous motor is to be added at the *load* both to compensate for the lagging current taken by the induction motors and to supply additional power. Assume that the efficiency of this synchronous motor is 92.5 per cent at full load and unit power-factor. The voltage at the load is maintained constant and the frequency is 25 cycles. (*a*) Calculate the kilovolt-ampere capacity of the synchronous motor so that the generating station can deliver its full load at unit power-factor. (*b*) What additional load can the synchronous motor supply? (*c*) At what power-factor will it be necessary for the synchronous motor to operate? (*d*) What is the necessary line voltage at the generating station before and after the synchronous motor is added?

This problem illustrates the use of a synchronous motor at the end of a transmission line to improve the power-factor.

Answers to the above problems and two new problems will be printed in the next issue.

Answer to Question e.

The losses in the transformers are:

$$P_t=3\times(2{,}120+28.6^2\times4.85)$$
$$=18{,}270 \text{ watts.}$$

The line loss is

$$P_L=3\times49.6^2\times10.82$$
$$=80{,}000 \text{ watts.}$$

The losses in the generator are:

Armature copper and stray losses
$$=3\times49.6^2\times1.42$$
$$=10{,}500 \text{ watts.}$$

Friction and windage
$$=11{,}200 \text{ watts.}$$

Field copper loss
$$=129^2\times0.802$$
$$=13{,}400 \text{ watts.}$$

Core loss $=33{,}200$ watts.

The core loss is found from the characteristic data corresponding to an open-circuit voltage equal to the terminal voltage plus the Ir drop, viz., E' in Fig. 41a.

The horizontal and vertical components of E' are

$$E'_h=8{,}600\times0.823+49.6\times1.42$$
$$=7{,}150$$
$$E'_v=8{,}600\times0.567$$
$$=4{,}880$$
$$E'=\sqrt{7{,}150^2+4{,}880^2}$$
$$=8{,}660$$

The corresponding line voltage is $8{,}660\sqrt{3}=15{,}000$ volts. For this open-circuit voltage the core loss is

$$P_c=23.2+(35.6-23.2)\times(15{,}000-12{,}950)/(15{,}500-12{,}950)$$
$$=33.2 \text{ kilowatts.}$$

The total generator losses are

$$P_g=10.5+11.2+13.4+33.2$$
$$=68.3 \text{ kilowatts.}$$

The entire losses are

$$P=18.3+80.0+68.3$$
$$=166.6 \text{ kilowatts.}$$

The output of the transformers is 958 kilowatts. Thus the total input to the generator is $958+166.6=1{,}125$ kilowatts.

The efficiency is

$$\eta=958/1{,}125$$
$$=85.1 \text{ per cent.}$$

Copper from Chile and Peru.

The west coast of South America has materially increased its exports of copper, especially to the United States, according to the foreign trade department of the National City Bank of New York. Pig copper from Chile and Peru arriving in the United States in the eight months ending with February, amounted to 52,000,000 pounds, against 42,000,000 pounds in the same months of last year, and in February alone 11,000,000 pounds, against 7,000,000 pounds in February of 1914. Of copper ore the arrivals from the west coast are chiefly from Chile, and show a slight reduction when compared with last year.

The United States, although by far the largest copper producer of the world, is also a large importer, the total value of copper imports in 1914 having been $55,000,000, against $22,000,000 in 1904, an increase of 150 per cent in the decade.

Foot-Candle Intensities and Simple Rules Recommended for Efficient Illumination.

V. H. Mackinney, in discussing good lighting and its effects before the Yorkshire (England) Section of the Institution of Electrical Engineers, recommended the following average foot-candle intensities for the classes of service specified:

Art gallery (walls)	5.0
Automobile showroom	2.0
Bank (general)	2.0
Bath (public)	
Dressing rooms	1.0
Swimming bath	2.0
Billiard room (general)	1.0
Billiard table	15.0
Courts—	
Squash	6.0
Tennis	6.0
Church	3.0
Desk	4.0
Drafting office	8.0
Drill hall	3.0
Engraving	10.0
Factory—	
General illumination (only where additional special illumination of each machine or bench is provided)	1.5
Local bench illumination	4.0
Complete (no local illumination)	4.0
Garage	2.0
Gymnasium	2.5
Hospital—	
Corridors	0.5
Wards (with no local illumination supplied)	0.5
Wards (with local illumination supplied)	1.5
Operating table	12.0
Laundry	1.0
Ironing table	4.0
Library—	
Stock room	1.5
Reading room (with no local illumination)	4.0
Reading room (with local illumination)	1.0
Market	3.0
Motion-picture theater	2.0
Museum	3.0
Office (general)	4.0
Power house	2.0
Railway carriage	2.0
Reading (ordinary print)	4.0
Reading (fine print)	6.0
Residences—	
Porch	0.5
Hall (entrance)	1.0
Drawing room	1.5
Sitting room	1.5
Dining room (general)	0.5
Local (on table)	4.0
Kitchen	2.0
Bedroom (general)	1.0
Dressing table	4.0
Restaurant	3.0
Rink (skating)	3.0
School—	
Classroom	3.0
Corridor	0.5
Sewing	6.0
Shop window—	
Light goods	8.0
Medium goods	16.0
Dark goods	20.0
Shops (interior)—	
Light goods	5.0
Dark goods	10.0
Station (railway)	2.0
Street—	
Business (not including light from shop windows, etc.)	0.5
Residence	0.1
Country roads	0.05
Studio	4.0
Theater—	
Lobby	3.0
Auditorium	2.0
Train shed	1.0
Type-setting	8.0
Warehouse	1.5
Wharf	1.0

Mr. Mackinney gives the following simple rules for insuring good lighting:

Don't work in a flickering light.

Don't expose the eyes to unshaded lights in the direct range of vision.

Don't judge illumination by the brightness of the lamps.

Avoid extensive contrasts.

Use the right type of globe, shade, or reflector.

Make sure that the illumination is sufficient.

Keep lamps, globes, and reflectors clean.

Make sure that the lamps are in the right positions.

Visibility.

C. C. Paterson and B. P. Dudding opened a discussion on April 27 in London before the British Illuminating Engineering Society on some practical aspects of the question of visibility. Some of the practical points which engaged their attention were: (1) the visibility of distant lights at night; (2) the visibility of objects illuminated by the beam of a searchlight or motor headlight; (3) the visibility of objects in close proximity to bright lights; (4) the relative visibility of objects by direct and indirect light.

In regard to visibility and distance they arrived, from certain experiments, at the conclusion that for an object subtending an angle less than about ten minutes of an arc (about one foot at one hundred yards), the brightness for equal visibility must be proportional to about the square of the distance from the observer, but for objects subtending larger angles than this the brightness for equal visibility must be proportional simply to the distance between the object and the observer.

In regard to the visibility of detail by direct and indirect light, the authors hold that the discrimination of detail in certain circumstances depends almost entirely either on shadow or on the direction of the incident light. Where the surface of an object to be viewed is uneven but uniform in color, the only way in which the unevenness can be shown up is by differences in the illumination of such surfaces caused by the different angles which they present to the incident light. If the unevennesses are very deep they will be shown up by the shadows which are thrown by the raised portions on to the surrounding surfaces. For instance, in the case of embossed lettering inefficiency of thoroughly diffused or indirect light is most marked. One of the authors has for more than ten years used indirect lighting for domestic use, and for a long time he ridiculed the frequently repeated assertion that it was a most unsatisfactory light by which to do needlework and particularly darning. He has come to see, however, after experiment, that the contention is perfectly sound and that there is nothing so good as a unidirectional light giving sharp shadows for the discrimination of detail in needlework of all kinds. Indirect lighting, with its soft shadows, is considered an ideal light for domestic use, except in respect to this one particular.

Minnesota Engineers Active.

A joint meeting of the Minnesota Sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers was held in the engineering auditorium of the University of Minnesota on the evening of May 10. The members listened to two interesting lectures. H. E. Brillhart, of the Minneapolis General Electric Company, discussed the various features of the electric drive of the dredge which is doing extensive work for the Minneapolis Park Board at Lake Nakomis. H. F. Teetsell, superintendent of the Waldorf Box Board Company, told of the power conditions and the method of drive used in the Waldorf factory.

The electric dredge, the principles of which Mr. Brillhart discussed, is said to be operating at a lower cost than if the same machinery were driven by steam. It is equipped with a 500-

Five-Lamp Standard at El Paso and South-Western Depot, Tucson.

horsepower synchronous motor, driving through gears a centrifugal pump, Mr. Brillhart said. The gears are capable of two speeds. The electric service is carried to the dredge on the same pontoons that are used to carry the pipe line. The whole is simple and compact and free from a number of undesirable features entailed in steam power operation.

Officers for the Minnesota Section of the American Institute of Electrical Engineers were elected as follows: Chairman, E. T. Street, Consumers' Power Company, St. Paul; secretary, Walter C. Beckjord, electrical department of St. Paul Gas Light Company; new member of the executive board, Prof. F. W. Springer, electrical engineering college of the University of Minnesota; delegate to the national convention, Emil Anderson, Minneapolis.

Plans are under way for a final spring meeting of the electrical engineers of the state. It will be held jointly with the Minnesota Section of the American Society of Mechanical Engineers, and will take place in Duluth, June 11 and 12. The members will go in special cars from the Twin Cities on the morning of June 11. A meeting will be held in the evening at which an illustrated lecture will be given by J. B. Crane, general superintendent of the Great Northern Power Company, describing the plant of the company, a hydraulic installation of 54,000 horsepower, which supplies power for the operation of the lighting, the railways and the industries of Duluth and Superior. A lecture on the "Iron-Ore Industry of Minnesota," illustrated with motion pictures, will be given by J. H. Harding, assistant general manager of the Oliver Iron Mining Company.

On June 12 the engineers will be guests of the Duluth Commercial Club on an excursion to the $15,000,000 plant of the United States Steel Company, which is nearing completion. The electrical engineers will be especially interested in the four 3,000-kilowatt gas-driven generators, together with the 6,000-horsepower motors in the rail mill which are already installed.

Tungsten Ores.

The output of tungsten ores in 1914 was below normal.

Prices ranged from $6.50 to $9 a "unit" (that is, so much a short ton for each per cent of tungsten trioxide), depending on the quality and quantity of the ore and the urgency of the buyers' and sellers' needs.

Of the various tungsten minerals, the one produced in largest quantity was scheelite, from the Atolia district, in the Mohave Desert, Cal.

The more easily mined tungsten ores which lie close to the surface are now largely worked out in the older districts, and mining is thus becoming more difficult and expensive; this is especially hard on the small operator.

The European war disturbed tungsten mining, as it did most other lines of business, and has had much to do with the reduced output, but the imports of ore, tungsten, and ferrotungsten, as shown by figures collected by the Bureau of Foreign and Domestic Commerce, have been affected even more. During the year 267 tons of ore, valued at $139,697, were imported, against 401 tons, valued at $213,122, in 1913. During 1913 661 tons of tungsten metal and ferrotungsten, valued at $835,212, were imported. In 1914 these imports dropped to 192 tons.

Tucson's Ornamental Street-Lighting System.

The city of Tucson, Ariz., is justly proud of its ornamental lighting system recently completed. A design of the most serviceable and artistic type of present-day standards, submitted by E. E. Russell, manager of the Russell Electric and Machine Company, was accepted for this and future installation. The material was furnished by the Russell Electric and Machine Company and installed by the city under the supervision of John Whitestone, city electrical engineer.

The system installed is a series street-lighting system where No. 8 lead-covered cable is carried in fiber conduit laid in concrete from the substation. The lights are controlled from the substation by two 17-kilovolt-ampere and one 12-kilovolt-ampere Westinghouse constant-current regulators.

There are 75 five-light standards in-

One-Lamp Standard, Pennington Street, Tucson.

stalled on Congress Street from the El Paso & Southwestern depot to the Southern Pacific depot and on Stone Avenue from Broadway to Pennington Street; 75 one-light standards are installed on Pennington Street from Main to Toole Avenue, on Convent Street from Congress to Pennington, on Church Street from Congress to Pennington, on North Stone Street from Pennington to the Southern Pacific tracks and on South Stone Street from Broadway to Thirteenth Street. A number of combination poles are now being installed to replace some of the five-light standards, where the light company's posts interfere with ornamental standards at street intersections.

The standards are placed 120 feet apart covering 9,000 feet of street length. The five-light posts are placed opposite

each other and parallel. The one-light standards are staggered and parallel.

The standards are 13 feet 6 inches high and are fastened by bolts to a substantial concrete base. Each five-light post has a four-light arm 12 feet from the curb, carrying four 60-candlepower new type C 6.6-ampere series Mazda lamps and fitted with 12 by 6-inch Nuglass globes. The top light of these posts and the one-light posts carry one 100-candlepower new type C 6.6-ampere series Mazda lamps, each fitted with a 16 by 8-inch Nuglass globe.

All costs for installing, maintaining and operating this system are paid by the city of Tucson. The installation cost for five-light standards was $143.23 per standard. The proportionate cost was as follows: conduit, wire and terminals, 60.0 per cent; standards, 26.2 per cent; lamps and glassware, 7.7 per cent; labor and incidentals, 6.1 per cent. The installation cost of one-light standards was $101.76 per standard, proportioned as follows: conduit, wire and terminals, 61.3 per cent; standards, 28.4 per cent; lamps and glassware, 3.6 per cent; labor and incidentals, 6.7 per cent. The above costs do not include the station transformer and current regulators, this portion of the installation costing $2,389.25.

The maintenance expense is estimated as follows: lamp renewals (five-light standards), $4.12 per post yearly; lamp renewals (one-light standards), $2.00 per post yearly. The energy cost for operating the lamps will be five cents per kilowatt-hour.

The top lamps of the five-light posts and the lamps on the one-light posts burn every night and all night. The other four lamps on the five-light posts burn every night from dusk to 10:30 p. m. These lights are turned on and off by patrolmen at the transformer station.

Congress Street From El Paso and Southwestern Depot, Tucson.

White Way in Sandusky, O.

This ornamental system is proving highly satisfactory in every respect. Merchants are remodeling their windows to keep pace with the lighting improvements. More people are out in the evenings and fewer patrolmen are needed. The city officials have been so highly gratified that they are already preparing specifications for doubling the present system.

Berlin Central Station.

The present arrangement between the City of Berlin and the Berlin Electricity Company terminates on October 1 of the present year, and the officials of the Berlin Electricity Works have declared that in spite of the war they do not see their way to prolong the term. The City of Berlin will take the plant over on October 1. It commenced in the year 1885 with 3,000 incandescent lamps, but on June 30, 1914, current was supplied by the company to 2,106,801 incandescent lamps, 44,171 arc lamps, 42,943 motors, and 7,867 other electric machines. The energy supplied has grown to 267,600,000 kilowatt-hours for the last financial year. Of this 75,500,000 kilowatt-hours for power purposes, 73,100,000 kilowatt-hours for railways, 62,100,000 kilowatt-hours for lighting, and 56,900,000 kilowatt-hours supplied as high-voltage energy, which, when transformed, is used for both power and lighting.

White Way at Sandusky.

Sandusky, O., celebrated the opening of a new "White Way," on April 30, with regular civic festivities. Upwards of 10,000 people turned out to see the new lights turned on for the first time—the turning on being done by Mayor Jacob Dietz, following a brief speech of presentation by Major C. B. Wilcox, managing director of the Sandusky Gas & Electric Company. There followed a parade through the "White Way" district in which the National Guard, Boy Scouts, city police and fire departments, Sandusky Ad Club, Newsboys' Association and other civic organizations participated. Following the parade was a band concert and some speeches and the evening's festivities wound up with a banquet at the Hotel Rieger, at which the principal speaker was Congressman A. W. Overmyer.

The Sandusky "White Way" is regarded as the last word is ornamental street lighting, at this period. It covers 14 city blocks, comprising the main business section, and consists of 380 nitrogen-filled tungsten lamps of 250 candlepower each, mounted on 190 ornamental standards. The standards are approximately 50 feet apart. The result is an evenly and brilliantly lighted district—literally "as light as day."

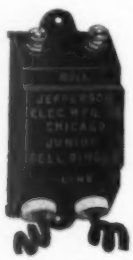
In addition to the "White Way" the utility company is installing a complete lighting system for the city, using 920 additional nitrogen-filled tungsten lamps of 60 candlepower and 100 candlepower each. The plans call for at least one lamp on each street corner in the city and from one to three lamps between corners, so that every street will be well lighted over its entire length. The lamps are hung about 15 feet above the surface of the streets, throwing the light under the foliage. In the "White Way" district all electric, telegraph and telephone wires are required to be put underground within the present year. The lighting is installed under a ten-year contract which expires December 31, 1924.

New Electrical and Mechanical Appliances

Efficient Bell-Ringing Transformer.

It is more important that a bell-ringing transformer should be properly designed than any other electrical device ordinarily connected on the house circuit. The average electrical appliances, such as toasters, percolators, curling irons, chafing dishes, etc., are not on the circuit more than part of an hour at a time, and whether they are efficiently designed or not makes but little difference to the consumer as far as his bill is concerned.

A bell-ringing transformer, however, is connected to the circuit continuously, so that there is a certain amount of current flowing through it at all times. A transformer that is not properly designed will consume considerable current continuously. Even if this loss amounts to only two or three watts, it will run up to several dollars a year. Therefore to avoid complaints it is well, before adopting a bell-ringing transformer as a standard, to take the trouble to test it.



Small and Efficient Bell Ringer.

The illustration herewith shows the Jefferson bell-ringing transformer, designed by probably the oldest and most experienced men in the low-voltage field. The core loss in this transformer is less than three-fourths of a watt. This is not sufficient power to register on the average watt-hour meter. This little transformer, owing to its efficiency, will take care of a greater amount of signal work than the average small transformer. It has sufficient capacity to operate all standard types of door openers, bells and buzzers.

This transformer, as well as a complete line of bell-ringers and toy transformers, is manufactured by the Jefferson Electric Manufacturing Company, 849 West Harrison Street, Chicago, Ill.

Compact Examination and Pocket Lamp for Physicians and Nurses.

Specialists who devote themselves to the treatment of nose and throat troubles are usually provided with a special equipment for throwing light into those parts when making examinations. Physicians in general practice, when visiting patients seldom can use such an outfit, although the need for it frequently arises. To meet their requirements by means of a very handy and light-weight examination lamp, there has been placed on the market by the Lindstrom, Smith Company, 1102 South Wabash Avenue, Chicago, Ill., the device illustrated herewith.

This outfit is no larger than a pencil or fountain pen, and can be easily carried in the vest pocket or nurse's handbag. The switch provided at the end is also used as a clamp to prevent the outfit from slipping out of the pocket. Clamped about the barrel and extending in spiral form into the rays of the lamp is shown a tongue depressor which is very convenient in examinations of the pharynx and throat. This tongue depressor can be easily slipped on or removed and kept in the instrument case. The case and tongue depressor are very heavily nickeled and highly polished. A high-efficiency miniature lamp is used in connection with a powerful dry battery, so as to give service for at least 1,000 flashes. The outfit is five inches long by five-eighths inch in diameter.

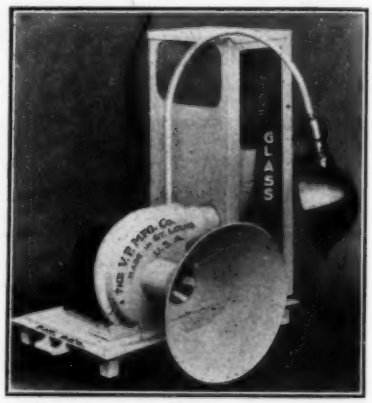
Physician's Examination Lamp.

Although designed particularly for physicians, dentists and nurses for examination purposes, it is also very convenient for any purpose where a pocket-size lamp is desired.

Electrically Operated Fly-Catcher.

A unique type of fly-catcher has been placed on the market by the Vogel Products Manufacturing Company, 1616 Chestnut Street, St. Louis, Mo. This machine is particularly useful in groceries, meat markets, commission houses and other places where provisions are sold or stored. It has also been used in restaurants, dining rooms, etc.

The outfit consists of a motor-driven suction fan which draws in a strong current of air through a funnel-like opening and drives the air, with its entrained insects, through the suction blower and into a cage with glass sides This cage is made of steel and has a screened outlet near the top. Just within this screen in the cage is a sponge kept moistened through a small drip cup at the top. This sponge serves to absorb dust and dirt drawn in along with the insects. The cage is easily removed and can be readily cleaned. During the day any material with a strong and attracting odor, such as banana oil, is placed near the opening to attract the insects. A lamp with reflector is provided with the outfit to throw light into the opening and thus attract the flies at night. The machine shown weighs about 30 pounds complete. It takes only about one-half ampere to operate it and it can be run from any lighting circuit.



Electric Fly-Catcher.

This fly-catcher is made in three sizes, the largest of which is mounted on a small cart to make it more readily portable. The machines are provided with an automatic make-and-break device by means of which the motor runs for about 6 to 10 seconds and then stops for 10 to 20 seconds. This intermittent operation serves to attract the insects even more than if the outfit were steadily running.

New Way of Selling Sockets.

Paiste sockets, for which the Hart & Hegeman Manufacturing Company, Hartford, Conn., is selling agent, can

Part 50—Key Interior and Shell.

Part 51—Keyless Interior and Shell.

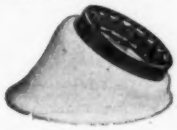
Part 52—Pull Interior and Shell.

Part A—⅛-in. Cap.

Part J—¼-in. Cap.

Part K—⅜-in. Cap.

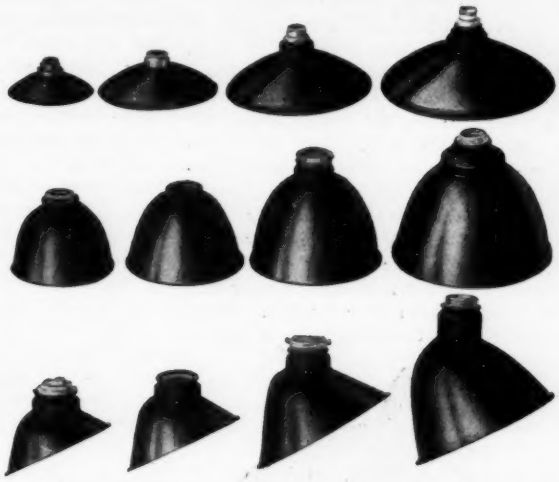
Part N—Plain Wall Base.



Part H—Angle Wall Base.

Part P—Covered Wall Base.

Simple Method of Ordering Paiste Socket Parts and Combinations.



Flat-Cone, Bowl and Angle Forms of Benjamin Shade-Holder Type Reflectors.

now be bought unassembled. Each cap, base, and shell with interior is boxed separately and can be bought by itself. This enables dealers and users to have a very complete stock with a very small investment.

From a stock of a few parts, four to five times as many different types of sockets can be assembled. Because of the small number of different pieces to be handled, this way of buying also makes work very easy for the stock keeper, both in keeping his stock in shape and complete and in picking out the material that is required on a job.

To make ordering easy, each part is designated by a letter or number. An illustrated sheet is furnished showing the different parts with descriptions and prices.

A few of these are shown above. The numbers and letters under the cuts show the idea. In ordering assembled sockets, the letter and number of the desired cap and shell are combined; for example, an "⅛ key socket" is ordered as "A-50."

A Simple 2,500-Volt Lightning Arrester.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces an addition to its extensive line of lightning arresters in the form of a low-priced spark gap and resistance arrester, known as the type CR.

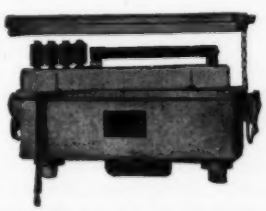
This is a single-pole lightning arrester for alternating-current circuits of any frequency or capacity and for voltages up to 2,500. The arrester may be installed out of doors on poles or buildings, or indoors on station walls. The weatherproof metal case effectively protects the arrester units from rain or snow when installed in exposed places.

The new type of lightning arrester consists of a series of spark gaps between non-arcing cylinders in series with a resistor. Four cylinders are used for the spark points, so that in case of burning the cylinder can be turned to give a new arcing surface.

The resistor prevents the power arc that might occur on systems of large capacity if the spark gaps alone are used, making the arrester suitable for

Lightning Arrester for 2,500-Volt Lines.

circuits of any capacity. The resistance is low enough to give good protection, but high enough to insure reliable operation, and to enable the non-arcing



Arrester Opened to Show Interior.

metal gaps to quench the arc at the end of the first half cycle.

The resistor material is a new composition that is absolutely unaffected in its resistance by static discharge. The discharge voltage is as low as is practical for use on 1,250 to 2,500-volt circuits.

The manufacturers recommend one set of type CR lightning arresters at each distributing transformer, with a minimum of five sets per mile of line.

Benjamin Shade-Holder Type Reflectors.

The problem of proper light distribution for industrial plants brings with it two particular questions to settle in relation to reflectors to properly distribute or direct the light generated. Granted that the correct type or shape is decided, there remains the question of material. It is manifest that the average manufacturer or owner of a plant would much prefer to have all of his reflectors made of metal, could he by so doing obtain neat appearance and at the same time the efficiency required.

The Benjamin Electric Manufacturing Co., 128 South Sangamon Street, Chicago, Ill., has through its engineering staff scientifically designed and is now offering a full line of steel reflectors with the idea of meeting just the condition described, that is, a combination of high efficiency with graceful and attractive outline.

These reflectors are made in several styles, viz., flat cone, fluted, deep bowl, shallow bowl and angle, and in distributing and focusing types. Finish may be had in either green or white enamel, or aluminized steel.

This line of reflectors is further distinguished by the fact that they have "built-in" holders, devices whereby they may be quickly attached to any socket, whether brass shell, porcelain, or the company's "Benco" socket. This feature has given the reflectors their name, the "Benjamin Shade-Holder Type Reflectors."

Burma Needs Electricity.

Electrical development in the Burma section of India is in its infancy. Outside of Rangoon and Mandalay there are no electric plants, except a small lighting set in the oil fields at Yenangyoung.

Meleady Loom Box.

A very simple and sturdy type of loom box has been designed by J. T. Meleady, an experienced electrician, who incorporated in the design what he found to be the requirements for a box of this type. The box combines in one unit an outlet box, a fixture stud or collar, and a simple and reliable means of automatically gripping the loom or flexible fiber duct. The flange of the box is of uniform height all around so that plaster can be brought flush with its top. Being entirely self-contained, the device is

Meleady Loom Box.

very easily installed since there are no loose parts to cause annoyance or delay. It is made for both straight electric and combination gas and electric outlets and in each case is made with either two or four holes for loom. The box is low in price and is being manufactured by the Sterling Foundry & Machine Company, Newark, N. J.

New Attachment Plugs.

Two new forms of attachment plugs have been added to the line of products made by the Arrow Electric Com-

Fig. 1.

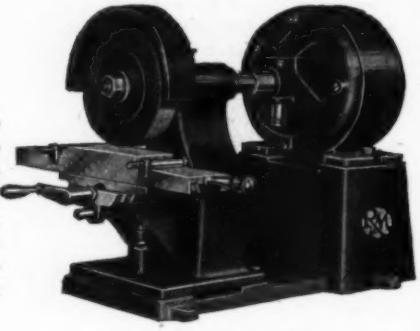
Fig. 2.

pany, Hartford, Conn. They are of very simple design and sturdy construction. The one shown in Fig. 1 has a brass cap of the bayonet type screwed to the body of the plug by two set-screws in the sides. This brass cap has a double bushing, of which the inner sleeve has an internal diameter of nine-thirty-seconds inch to make it suitable for No. 16 approved lamp cord. If larger cord is to be used the inner bushing is removed, thus leaving the outer bushing which has a hole thirteen-thirty-seconds inch in diameter. These plugs are ordinarily made fuseless and also of the fusible type when required.

In Fig. 2 is shown a weatherproof plug made of molded insulating material. This plug is especially useful for outside service and in damp locations. Each plug is provided with six inches of No. 14 new Code, stranded, rubber-covered wire for attaching to the connecting cord. These wires are permanently screwed to the contacts in the body of the plug. Longer wires are furnished on special order. This type of plug is rated at 660 watts, 600 volts.

Electrically Driven Grinder for Preparing Test Samples of Rubber.

The machine illustrated has recently been developed by the Emerson Apparatus Company, 251 Causeway Street, Boston, Mass., for the purpose of preparing samples of rubber of absolutely uniform cross section, for



Rubber-Test-Sample Grinder.

tests of textile strength. Its principal use is for preparing samples of hose lining for test.

A section of hose several inches in length is slitted along its length, and the interior lining with its rubber backing is stripped from the fabric. This strip of rubber is cut to a uniform width of one inch throughout a distance of three or four inches along the middle of its length. The strip is then strapped closely to the platen of the grinder, smooth side down, and it is held firmly in position by the two eccentric rolls.

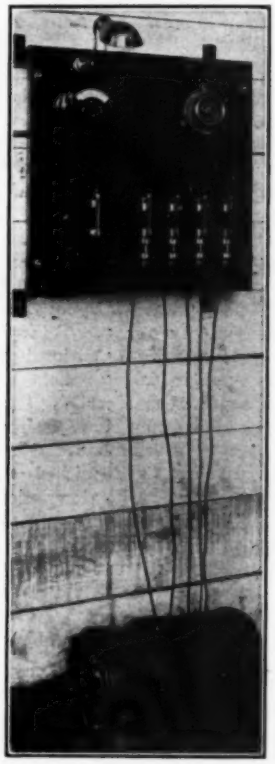
By means of the longitudinal, vertical and cross adjustment of the platen of the grinder, the sample may be quickly ground down to an absolutely uniform thickness throughout the length of the test section.

The grinder is direct-driven by a one-sixth horsepower motor, manufactured by the Robbins & Myers Company, Springfield, O.

Lincoln Charger for Sparking and Lighting Batteries.

Realizing the increasing demand for a device for charging sparking and lighting batteries, the Lincoln Electric Company, Cleveland, O., has developed a motor-generator set for this purpose. The outfit comes complete with switchboard. The motor-generator set is a two-bearing ball-bearing machine, thus securing perfect alinement of the bearings. The set consists of a single-phase motor with a shunt-wound direct-current generator.

The motor is non-self-starting and is started up from the direct-current end, a small current being taken from the battery which is to be charged, the generator acting as a shunt motor. This method of starting is accom-



Charging Set for Ignition Batteries.

plished by having two middle clips of the four-pole switch higher than the remainder. These are connected to the battery and engaged first as the switch is closed. When these are engaged by the switch, it throws the battery across the armature and the machine starts to revolve. When the set comes up to speed, the switch is thrown entirely in and, the alternating current being thus thrown on, the set starts to charge the battery. The batteries are charged in series, the charging current being varied by raising or lowering the field voltage. This makes a very flexible arrangement and is one

suitable for garages where the number of batteries charged varies from day to day. The set is very simple and gives excellent results.

On the switchboard, which is about 24 inches square and arranged for wall mounting, are mounted a starting switch, voltammeter, pilot lamp and a switching device arranged to switch one, two, three, four, etc., cells in series for charging.

The outfit is made in two sizes, the smaller accommodating any number of cells from one to eight, the larger accommodating any number of cells from one to fifteen. It is expected that the plant will appeal particularly to garage men. The illustration herewith shows one of the complete sets temporarily set up for test in the shop.

Hughes Junior Electric Range for Teaching Children How to Cook.

In the opinion of many parents the playthings that children occupy themselves with should be of an educational character. Therefore those things that are likely to interest them when grown up have always proved very popular.

Carrying out this idea, the Hughes

Children's Electric Range.

Electric Heating Company, 211 West Schiller Street, Chicago, Ill., has added to its line of electric ranges the type illustrated herewith. This is a miniature electric range complete in every particular and is not a toy in the ordinary sense of being cheaply made and purely for play. It is very compact, the total height being but 15 inches and the net weight of the complete set but 7.5 pounds. The cooking surface has six small heating units or burners and has an area of 11.25 inches by 8 inches. The oven is 4.5 inches wide, 2.25 inches high and 5 inches deep. The range is finished in black enamel with nickel-plated top, legs and oven door. It makes a very attractive appearance and is a thoroughly practical device. This range takes less current than an ordinary flatiron and can therefore be easily attached to any lighting outlet through the connecting cord and plug furnished with the device.

With every range there is furnished free a set of small cooking utensils and a cook book written in simple style that children can readily understand. This range is well calculated to initiate the youngsters into the merits of electric cooking at an early age. It is absolutely safe and therefore greatly superior to the plan of permitting children to practice cooking on a gas range or other stove.

A New Line of Portable Electric Drills.

The Western Electric Company has placed on the market what is known as the Temco line of electric portable drills. These are specially designed to give long and efficient service under severe conditions and hard usage and are essentially all-around tools. These

One-Motor Drill.

electric drills have the general shape of an ordinary breast drill, are compact in design and light in weight. The weight is well balanced, making handling easy and the electric switch is conveniently placed near the handle.

A special feature is the ease with which the motor may be reversed when the drill sticks. Whether working at high or low speed, a touch of the switch reverses the motor, loosening the drill or sending it ahead as required. These drills will also tap holes, the reversing feature being here of great advantage.

Western Electric Temco drills are very useful wherever holes are to be drilled or tapped and particularly where the material cannot be carried to a drill press, the tool being carried to the job. For working inside objects, or upside down and in other inconvenient places, these portable drills are exceptionally useful.

The motors are built to operate on either direct current or alternating current at standard voltages. Connection is made to the nearest lamp socket by means of a flexible cord and attachment plug.

The motors are of the high-speed commutator type having forged nickel-steel shafts and built-up cores of magnetic steel. The commutator consists of highly conducting hard-drawn copper bars of ample carrying capacity forced together under high pressure and insulated by selected mica.

The two principal sizes are Model B and Model C, the former having one motor and the latter having two motors, making it especially adapted to the hardest kind of work. Model B has a capacity up to and including three-eighths inch in steel, cast iron or similar substance, and weighs only 12 pounds complete. Model C has a capacity of one-half inch in steel, has two speeds and weighs, without the chuck, about 19 pounds.

Two-Motor Drill.

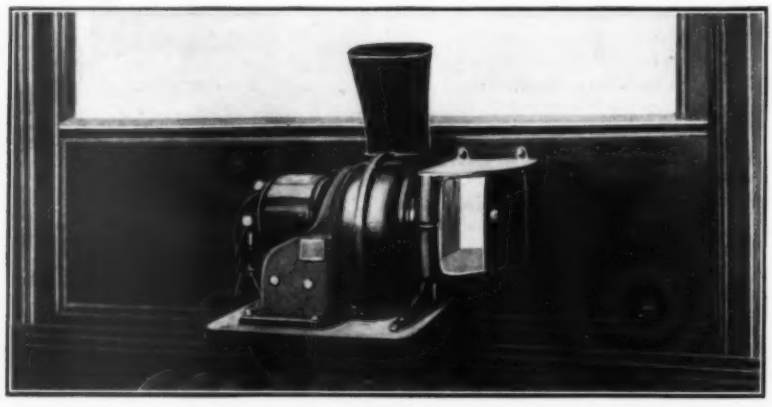
Foreign Trade.

The India correspondent of the London *Electrical Review* reports that firms in America are inundating India with business circulars and lists, and electrical firms especially are busy in this direction. Both English and American firms make the same mistake in common, namely, they do not give sufficient particulars as to prices, discounts and deliveries. It would save money in postage and printing, if fewer catalogs and lists were sent out giving better selling particulars and lowest rates f. o. b. home ports, or c. i. f. India, to a select number of serious firms, whose names can be found in any universal directory.

Hygienic Ventilation by Cold Outdoor Air Without Drafts.

Some ventilating authorities have come to the conclusion that ventilation in winter with cold outdoor air is impractical owing to the tendency of very cold air to resist rapid diffusion with the warmer air of the room. The air warmed by the radiators goes to the ceiling, while the cold incoming air falls to the floor. The Gerdes ventilator, manufactured by Gerdes & Company, 30 Church Street, New York City, overcomes this difficulty in two ways: By blowing the cold air to the ceiling with sufficient velocity to cause it to creep along the ceiling until it falls away in all parts of the room, and, when the weather is very cold outdoors (below 25 degrees Fahrenheit), by mechanically mixing enough warm air from the room with the cold air to bring the temperature of the mixture to a normal coolness (about 30 degrees Fahrenheit). The result is that a uniform temperature exists from floor to ceiling and absolutely no drafts are felt; in fact, it is impossible to feel that cold air is coming into the room.

The ventilator consists of a Westinghouse Sirocco blower together with a combined duct and mixing chamber for bringing outdoor air or indoor air to the blower, or a mixture of the two sufficient to maintain a comfortable atmosphere in the room. When the slide in the duct is brought forward and the duct closed to the room, the blower draws only cold outdoor air; when it is pushed back the cold air is cut off and air from the room is recirculated; when the duct is partly



Electric Ventilator with Slide Partly Open.

open to the room, as shown in the illustration, the slide closes the opening to outdoors by the same amount and streams of cold outdoor air and warm indoor air mix in the blower. By adjusting the slide any temperature can be had at the nozzle between that existing indoors and out. The cool mixture being blown to the ceiling, spreads out against it and, after losing its momentum, gradually sinks through the warm room air and is breathed before it returns to the radiators.

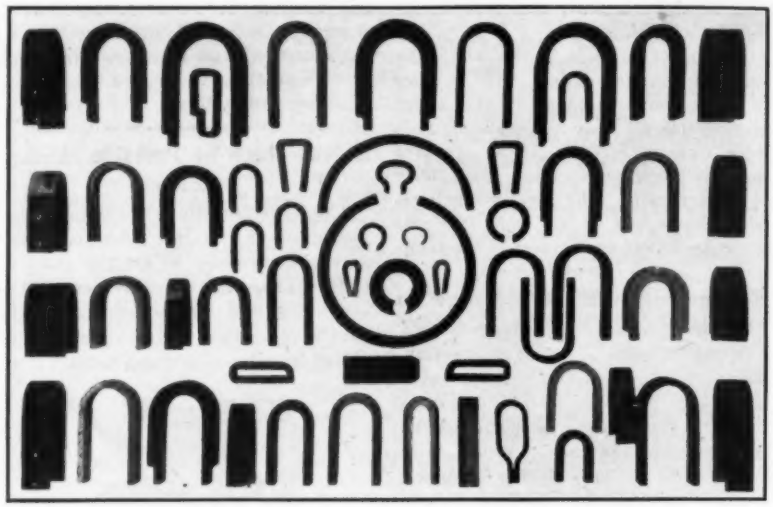
The outfit is operated by current from the lighting circuit. It requires about the same current as an ordinary incandescent lamp and no special wiring is necessary. It can be installed or removed in a few minutes and the placing of the window board causes no damage to the woodwork.

American-Made Permanent Magnets.

Illustrated herewith are some of the different varieties of permanent magnets manufactured for the trade by the Esterline Company, Indianapolis, Ind. This company has been making permanent magnets for the past fifteen years. The magnets shown are used mainly in electrical instruments, watt-hour meters and ignition magnetos.

J. W. Esterline, president and general manager of the Esterline Company, was for a number of years chairman of the Committee of the American Society for Testing Materials on the Magnetic Qualities of Iron and Steel, and is a recognized authority on this subject.

The Esterline Company's plant is



Some Types of Esterline Permanent Magnets.

equipped with the latest type of furnaces for treating tungsten steel. The company also builds machines for testing magnet steel and permanent magnets and its laboratories are equipped with apparatus for making rapid determinations of the quality of the steel used, as well as of the finished magnets. The company states that one of the reasons for its success in this line is the fact that it gives careful attention to testing of the raw material and the finished product. Every lot of steel received is tested before it is used, and the magnets are subjected to magnetic tests after they go through the different processes.

The furnaces are equipped with heat-regulating devices and recording pyrometers, and every known means is used for maintaining conditions as nearly constant as possible. By giving such close attention to the materials used and the processes employed, the company states that it has found no difficulty in producing magnets equal to and in many cases superior to the imported product.

The Esterline Company is at the present time exporting large quantities of magnets to England, France and other European countries, as well as supplying the demands of a large number of domestic users.

Thomas A. Edison has accepted the proposal of the Government to place his storage battery in the submarine E-2.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

ARC-LAMP FEED. — Royal Projector Company, 617 West Jackson Boulevard, Chicago, Ill.

This device consists of a current relay so designed that decrease in current, due to burning away of carbons, closes contact which actuates a relay, causing ratchet to engage with ratchet wheel on adjusting arbor of arc lamp, feeding carbons.

Listed April 20, 1915.

ATTACHMENT PLUGS, Fuseless. —American Electric Heater Company, Detroit, Mich. Manufactured by Peru Electric Company, Peru, Ind.

Composition cap and porcelain base, 660 watts, 250 volts, catalog No. 875.

Listed April 13, 1915.

CABLE, Armored. — Smurr & Kamen Company, 313 North Whipple Street, Chicago, Ill.

Marker: A green cord parallel with outer braid and armor.

Armored cables shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed April 10, 1915.

CABINETS.—A. M. Kailing Company, 280 West Water Street, Milwaukee, Wis.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed April 26, 1915..

CUTOUT BASES, Cartridge Fuse. —The Trumbull Electrical Manufacturing Company, Plainville, Conn.

Slate base.

250 volts, all capacities, catalog Nos. 8026, 8027, 8036, 8037.

600 volts, all capacities, catalog Nos. 8075, 8076, 8077, 8085, 8086, 8087.

Listed April 15, 1915.

FIXTURES. — Sunlight Reflector Company, 143 Court Street, Brooklyn, N. Y.

Sunlight Show-Window Reflector. A sheet-metal body with corrugated mirror reflectors and having main wires and taps to sockets with slow-burning insulation. Made on order specifying length of fixture and number and spacing of lamps.

Listed April 29, 1915.

FUSES, Cartridge Inclosed.—Killark Electric Manufacturing Company, 2005 Locust Street, St. Louis, Mo.

Killark cartridge inclosed fuses, 250 volts, 0-600 amperes.

Listed April 27, 1915.

HEATERS, Electric. — American Electrical Heater Company, Woodward, Burroughs and Cass Avenues, Detroit, Mich.

American beauty portable heating devices for voltages up to 250.

Ovens, 12 amperes, 95-104 volts, catalog Nos. 1212-14-16-18.

Listed April 27, 1915.

HEATERS, Electric. — Michigan Stove Company, Detroit, Mich.

Garland electric range, 9.8 kilowatts, 110 volts, direct or alternating current.

Listed April 27, 1915.

HEATERS, Electric.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Portable heating devices.

Radiators, 100-250 volts, 1000-6000 watts, type C, non-luminous.

Non-portable heating devices.

Bayonet-type water heater, type A, 100-125 volts, 4.5-10.5 kilowatts, styles 186054-186149 inclusive.

These heaters are judged to be less hazardous than stoves and heaters used for same purpose, which depend on direct combustion of fuel for heat. Precautions such as apply to stoves in common use should be observed in installation and use of these devices.

Standard when connected by standard fittings to wiring circuits of suitable capacity for current required, but not for connection to ordinary lighting circuits, nor to ordinary lamp sockets or receptacles.

Listed April 27, 1915.

HEATERS, Electric.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Disk stoves, 100-125 volts, 500 watts, styles 189197-202 inclusive.

Toaster stoves, 100-125 volts, 500 watts, styles 196157-59 inclusive.

Curling iron, 100-125 volts, 15 watts, style 185143.

Radiator, 100-125 volts, 500 watts, Cozy glow, luminous, styles 181420-24 inclusive.

Listed April 27, 1915.

PICTURE MACHINES AND APPLIANCES.—Atlas Educational Film Company, 5 South Wabash Avenue, Chicago, Ill.

Atlas special portable hand-operated picture machine.

The electrical parts of this device comprise an incandescent lamp of special form with socket and portable cord for attachment to supply circuit.

Standard for use only with standard slow-burning film supplied by manufacturer.

Listed May 3, 1915.

RECEPTACLES, Standard. — The Trumbull Electric Manufacturing Company, Plainville, Conn.

Porcelain receptacles, 660 watts, 250 volts.

For use on metal signs, catalog Nos. 946, 947.

Listed April 28, 1915.

SIGNAL APPLIANCES. — P. R. Manufacturing Company, Detroit, Mich.

Electric signal bells, 6-110 volts, direct and alternating current.

Marlo and weatherproof types.

Listed April 27, 1915.

SWITCHES, Combination Cutout.—Heinemann Electric Company, Girard Avenue and Fifth Street, Philadelphia, Pa.

Porcelain-base knife switches with Edison plug cutouts, catalog No. 200, 30 amperes, 125 volts.

Listed April 19, 1915.

SWITCHES, Combination Cutout. —Palmer Electric and Manufacturing Company, 161 Franklin Street, Boston, Mass.

Palmer fused service - entrance switches.

These devices are special knife switches with cutouts mounted on inside of hinged cover of an iron cabinet with sealable compartment for supply wires.

30 amperes, 125 volts, 125-250 volts, and 250 volts, catalog Nos. 306-309 inclusive.

Palmer meter-testing block, 30 amperes, 250 volts, catalog No. 800.

A porcelain base carrying terminals for meter-testing connections.

Listed April 21, 1915.

SWITCHES, Push-Button Flush.—General Electric Company, Schenectady, N. Y.

Double-pole, 20 amperes, 250 volts, catalog No. GE630.

Listed April 25, 1915.

SWITCHES, Push-Button Flush.—Union Electric Company, Trenton, N. J.

Single-pole, 10 amperes, 125 volts, 5 amperes, 250 volts, catalog No. 800.

Listed April 27, 1915.

SWITCHES, Surface Snap.—Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins. (With metal covers.)

Double-pole, double-throw, 10 amperes, 250 volts, catalog Nos. 2611-14 inclusive.

Listed April 28, 1915.

Current Electrical News

ATLANTIC STATES.

CAPE ELIZABETH, ME.—Street lighting and commercial services are being extended from Pond Cove to Crescent Beach, with a number of cottage wiring contracts in prospect.

TURNER, ME.—The Turner Light and Power Company has bought the Faulkner Wooden Mill Company, at Turner, where there is a dam capable of developing 100 horsepower daily for 12 hours a day throughout the year. An electric plant is utilizing a part of the power, and it is proposed by the new company to further develop it. The officers of the new corporation are: George C. Webber, president; Leon A. Wardwell, treasurer and general manager.

WESTBROOK, ME. — The Westbrook Electric Company has been organized to take over the lighting of this town, with a capital stock of $200,000. B. L. Merryman is president, and W. S. Linnell, treasurer.

RUTLAND, VT.—Plans for improving the State House of Correction include the installation of a new dynamo to operate electric fans and a new lighting system in the cells.

NEW BEDFORD, MASS. — The New Bedford Gas and Edison Light Company, of New Bedford, Mass., has recently completed a 22,000-volt transmission line from New Bedford through the towns of Fairhaven, Mattapoisett, Marion and Wareham. The new line is of steel tower construction and has required seven months to build. A load of 700 horsepower, soon to be increased to 1,500, is already connected. A new Marconi wireless station, soon to be put in operation at Marion, will use about 500 horsepower more. It is probable that the New Bedford company will extend its lines to the Cape Cod Canal, to provide light, and power to operate bridges over the canal.

WATERTOWN, N. Y.—The Northern New York Utilities Company, Incorporated, has purchased an interest in the Thousand Islands Electric Light and Power Company, of Clayton, N. Y., and will build transmission lines to Chaumont, Three Mile Bay, Depauville and Clayton.

ALLENTOWN, PA.—A large new three-story school building will be erected here by the School District. The plans include the most modern equipments for the heating, ventilating and electrical installations. Runyon & Carey, of Newark, N. J., are the engineers in charge. V.

NORTH CENTRAL STATES.

CANTON, O.—The Canton Electric Company has purchased ground and will erect an addition to its power station. The total cost of improvements authorized by the company since the first of the year amounts to nearly $250,000.

DAYTON, O.—An increase of $90,000 in the capital stock of the Oakwood Light and Water Company, in the village of Oakwood, is designed to provide for extensions of the company's plant, which will call for some additional electrical equipment. L.

YOUNGSTOWN, O.—Lighting in the public parks, including the tennis courts, is being discussed by the Park Commission with H. Whitford Jones, the city's lighting expert. The wiring will probably be placed underground, in order to avoid disfiguring the parks and injuring the trees by cutting and contact with the wires.

ANDERSON, IND. — Fire caused damage amounting to about $10,000, to the municipal electric light and water plants. Neither plant will be out of commission. The loss was fully covered by insurance. Address city clerk.

GALESBURG, ILL.—Contract for constructing an ornamental lighting system on several streets in this city has been let to H. H. Guenther.

VIROQUA, WIS. — The Viroqua electric plant, long owned by the heirs of the late William F. Lindeman, has become the property of H. A. Smith, Monroe. Improvements will be made. Abe Balseley, a well known Chicago central-station man, is the new manager.

BRAINERD, MINN.—At the final meeting of the water and light board, May 7, the last of the bonds for the electric light plant (amounting to $31,031) were taken up. The report of the electrical department showed that the balance on hand for April was $21,553.92. The amount received for electrical current was $3,962.68.

DULUTH, MINN.—The city commissioners, on May 6, voted to install a number of additional street lamps. All will be of the new tungsten 250-candlepower type. The cost to the city for maintenance will be $38 a year.

STEWARTSVILLE, MINN.—The business men of this village are considering the advisability of installing a white way.

ALLISON, IOWA.—Allison is to have electric lights, a franchise having been voted to the Cedar Valley Light Company. The current will be transmitted from Charles City or Hampton.

SHELLSBURG, IOWA.—Mayor L. A. Dickinson, of Shellsburg, has called a special election to the qualified voters of Shellsburg, for the issuing of bonds, in the sum of $10,000, for the purpose of procuring funds to erect an electric light and power plant, to consist of an overhead transmission and distributing system for the transmission of electric current throughout the town.

TIPTON, IOWA.—The council will vote, June 7, on the question of issuing $25,000 in bonds to purchase the plant of the Tipton Light Company. Address Mayor Bratley.

WILTON, IOWA.—The proposition made by the Davenport & Muscatine Interurban Company to build a transmission line to Wilton and furnish light and power to the city has been definitely turned down. Wilton will install a new city plant. Work will start as soon as possible.

CORDER, MO.—Corder has approved a $6,000 bond issue to establish a municipal electric light system. The current will be obtained from the Higginsville plant. Address mayor.

JOPLIN, MO. The Empire District Electric Company has been granted a franchise for operating a light and power system at Granby, Mo. The company has a contract to supply power for the 500-ton mill now being built by the Granby Mining Company.

ANAMOOSE, N. D.—It is understood that an electric light plant is assured for the town. The firm of Walper & Woodruff, electrical contractors of Bismarck, N. D., will have the contract for building the plant.

HAYS, KANS.—The city council is considering the installation of a municipal electric light system to cost $27,000.

MUSCOTAH, KANS.—The town is making preparations for an electric lighting system. If a plant is not built the power will be furnished from Atchison, the latter being the favored plant. Address town clerk.

SOUTH CENTRAL STATES.

CLAY, KY.—The Franklin Furniture Company has been inquiring for proposals on a two-ton warehouse elevator; voltage 110, 60-cycle, single-phase motor.

TOMPKINSVILLE, KY.—The local electric light plant has been purchased by J. R. White, L. W. Preston and Ed H. Smith of Glasgow, and H. B. Smith, of Glasgow, has been placed in charge of the property. It is stated that the new owners will provide for enlargements and probably install a water system.

WHITESBURG, KY.—The Starkey Electric Company, of Somerset, Ky., is expected to be granted the franchise for installation of an electric light plant in Whitesburg. The plans provide for a plant to supply 24-hour service and Fred Starkey is to be manager.

FRIENDSHIP, TENN.—The city has obtained introduction of a bill in the State Legislature providing that a bond issue may be voted for electric and other improvements.

GLEASON, TENN.—The board of mayor and aldermen, recently elected, is pledged to establish an electric light system at Gleason, as soon as bonds for the purpose are sold. This bonding proposition has been ratified, and it is probable that in a short time an election will be held for the purpose of issuing bonds to take over the present water plant.

HUMBOLDT, TENN.—W. M. Case, superintendent of the Humboldt water and power plant, has asked for prices on electrically driven centrifugal pumps.

MILAN, TENN.—Bonds to the amount of $12,000 have been voted to improve the water and light system. The Milan water and light plant is the old direct-current system and with the money derived from this bond issue it will be changed to an alternating-current system.

MEMPHIS, TENN.—The city, recently noted as voting on a $1,500,000 bond issue for an electric light plant, will postpone action for several weeks at least. Consulting engineers have been employed. J. H. Weatherford, city engineer, is supervising the project.

PLAINVIEW, ARK. — A franchise has been granted W. W. Winters to operate an electric light plant in Plainview for 25 years. Mr. Winters says he will have the plant in operation within 90 days.

HANNA, OKLA.—A. A. Sing plans to install an electric light and power plant here. D.

DEL RIO, TEX.—The electric light plant and ice factory of the Del Rio Electric Light and Ice Company, has been purchased by the Texas Southern Electric Company for $90,000. It is announced that improvements will be made to the property. D.

McGREGOR, TEX.—The Texas Power and Light Company has purchased the local electric light plant, and will connect it with its power system by the construction of a transmission line from Waco, via Eddy and Moody. Improvements will be made to the plant here. D.

MAYPEARL, TEX.—The Texas Power and Light Company will install an electric lighting system here. D.

SLATON, TEX.—The Malone Light and Power Company, of Plainview, plans to install an electric lighting system here. D.

WESTERN STATES.

FRIDAY HARBOR, WASH.—This city has been petitioned by R. D. Berghardt, of Seattle, for a franchise for the lighting and installation of lighting system in this city. Berghardt proposes to construct a power plant, providing the franchise is granted. O.

MORTON, WASH.—C. O. Smith has purchased the plant of the Morton Electric Company for $20,000. Improvements will be made.

OLYMPIA, WASH.—The city council has been petitioned by three separate and distinct corporations for lighting and power franchises in the city of Olympia—one is sought by William W. Manier and associates of Olympia, one by Scott Calhoun, Alaska Building, Seattle, and the other by George H. Tilden, Hoge Building, Seattle. This city is now served by the Olympia Light and Power Company. The first named petitioners Manier, et al., agree that the rates for city lighting shall be one-fourth that charged to private consumers. Calhoun promises that the rate to the city shall not exceed two cents for each kilowatt hour, on a contract for not less than 8,000 kilowatts, and the Tilden corporation agrees to charge the same as the Olympia Light and Power Company. The council will decide on the application early in June.

TACOMA, WASH.—C. E. Peterson, of Tacoma, recently applied to the county commissioners of Pierce County, for a franchise to construct a power plant and erect transmission lines for the purpose of furnishing a new residence section, known as Northeast Tacoma, with light and power. It is understood a plant will be constructed in the district. The addition is owned by the Lakewood Land Company.

GRESHAM, ORE.—Preparations are being made to secure water power rights near Sandy, Ore., where this city contemplates the installation of a municipal power plant, to be made in the future. It is reported papers will be filed at once. H. J. Stocker, of Gresham, has made preliminary surveys, and he estimates the cost of installation will be about $100,000. O.

LOS ANGELES, CAL.—The Public Service Commissioners have adopted a resolution requesting the city council to appropriate immediately the sum of $100,000 to permit the beginning of work on Long Valley dam and power plant at the Owens River gorge.

LOYALTON, CAL. — The State Railroad Commission has issued an order authorizing the Loyalton Electric Light Company to discontinue service in this town. Plans are under way for the installation of a new electric light plant here.

PROPOSALS.

ELECTRIC LIGHT FIXTURES.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 5, for electric light fixtures for the naval hospital buildings, Naval Station, Pearl Harbor, Hawaii. Plans and specifications may be obtained on application to the Bureau.

ELECTRIC LIGHT AND REFRIGERATING PLANT.—Sealed bids will be received until June 9, 1915, for furnishing all materials, machinery and labor required in constructing complete an electric light and refrigerating plant and installing an interior and exterior wiring system. A deposit of $10.00 is required for plans and specifications. Address, Construction Quartermaster, Fort Huachuca, Ariz.

ELECTRIC PASSENGER ELEVATOR.—Sealed bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until June 11, 1915, for the installation complete of an electric passenger elevator in the United States post office and courthouse at Augusta, Ga., in accordance with drawing and specification, copies of which may be had at the office of the Supervising Architect.

FINANCIAL NOTES.

The San Antonio Traction Company, a subsidiary of American Light and Traction Company, will increase its capital stock to $2,500,000. The $1,100,000 new stock will be taken by American Light and Traction Company in payment of advances made at various times to the subsidiary for purposes of capital improvements and betterments. The transaction amounts to the changing of debits against San Antonio Traction Company now standing on the books of American Light and Traction Company to fixed capital obligations of the subsidiary corporation taken into the treasury of the holding company.

It is announced by Kuhn, Loeb & Company, New York, that they had agreed to act as managers under the scheme for the retirement of the existing Westinghouse Electric and Manufacturing Company convertible sinking-fund five-percent gold bonds. This proposal contemplates the issue of an equal amount of new bonds for the old ones, with the terms of conversion into common stock changed so that the new bonds shall be convertible at the rate of $1,000 par value of stock for each $1,000 bond on or before June 30, 1915, and thereafter at the rate of $910 par value of stock for each $1,000 bond. The new bonds will first be offered to stockholders for pro rata subscription at 105.

Dividends.

	Term.	Rate	Payable.
Am. Railways	Q	1.25%	June 15
Central Miss. Val. Elec. Prop.	Q	$1.50	June 1
Chic. Rys. ser. 1 ctfs.	S-A	4%	June 5
Chic. Rys. ser. 2 ctfs.	—	2%	June 5
Gen. Elec.	Q	2%	July 15
Keystone Tel., pf.	—	2%	July 15
Mid. West Util., pf.	Q	1.5%	June 1
Phila. Elec.	Q	1.75%	June 15
Wisconsin Edison	—	$1.75	June 1

Reports of Earnings.

PHILADELPHIA ELECTRIC.

The annual report of the Philadelphia Electric Company for the year ended December 31, 1914, compares as follows:

	1914	1913
Gross	$8,160,025	$7,815,615
Net income	1,978,979	1,928,243
Dividends	1,574,038	1,180,815
Surplus	404,670	747,427
Previous surplus	1,067,076	1,818,913
Deduct stock dividends	.....	1,499,265
Total surplus	1,471,747	1,067,076

COLUMBIA GAS & ELECTRIC.

Columbia Gas & Electric Company reports income account for year ended December 31, 1914, as follows:

	1914	1913
Gross earnings	$6,322,401	$5,969,543
Net after taxes	3,644,384	3,394,899
Balance after rentals	1,066,246	808,944
Bond interest	516,239	499,225
Debt interest	123,262	61,600
Other interest	35,542	28,997
Surplus	391,291	219,121
Sinking fund	95,004	95,004
Balance	296,286	124,116
Electric customers	28,342	26,373
Pass. carried	28,944,392	27,792,423

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 17	May 10
American Tel. & Tel. (New York)	118¼	119½
Commonwealth Edison (Chicago)	133	—
Edison Electric Illuminating (Boston)	234	240
Electric Storage Battery common (Philadelphia)	50¼	51¼
Electric Storage Battery preferred (Philadelphia)	50¼	51¼
General Electric (New York)	147⅝	151
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	6	6⅞
Massachusetts Electric preferred (Boston)	39	41⅝
National Carbon common (Chicago)	131	131
National Carbon preferred (Chicago)	—	—
New England Telephone (Boston)	129	129
Philadelphia Electric (Philadelphia)	23⅞	24
Postal Telegraph and Cables common (New York)	76	77
Postal Telegraph and Cables preferred (New York)	63	65
Western Union (New York)	64½	65¼
Westinghouse common (New York)	86½	87¾
Westinghouse preferred (New York)	120	120

NEW INCORPORATIONS.

BROOKLYN, N. Y.—Ragovin & Feldman, Incorporated; electrical supplies, etc. Capital, $1,000. Incorporators: Irvin Brodsky, Charles Ragovin and William Feldman.

ITHACA, N. Y.—Cayuga Power Corporation; to manufacture electricity for light, heat and power. Capital, $75,000. Incorporators: Frank S. Connett, Harold Stanley and W. M. Rose.

NEW YORK, N. Y.—International Battery Company, Incorporated; to manufacture electrical equipment, etc. Capital, $5,000. Incorporators: Selim J. Grazi, Simon Frasy and Ezra Grazi.

BUFFALO, N. Y.—Niagara Electric Improvement Corporation; to manufacture electrical apparatus of all kinds. Capital, $50,000. Incorporators: S. Peik, L. C. Nicholson and R. C. Downing.

NEW YORK, N. Y.—George K. Webster, Incorporated; electric lighting fixtures and supplies. Capital, $10,000. Incorporators: George K. Webster, V. K. Webster and Maria V. Webster.

SAVANNAH, GA.—A charter has been granted to the Electric Construction and Fixture Company. Capital, $5,000. Incorporators: W. M. Coolidge, R. F. Smallwood and A. B. Connor.

NEW YORK, N. Y.—Sommer Lighting Fixture Company, Incorporated; gas and electric fixtures. Capital, $10,000. Incorporators: Charles R. Sommer, Edward C. Sommer and John T. Booth.

NEW YORK, N. Y.—Industrial Equipment Company, Incorporated; to manufacture electrical and mechanical apparatus, etc. Capital, $10,000. Incorporators: Arthur H. Ferber, Samuel B. Von Der Smith and James J. Donohue.

PERSONAL MENTION.

MR. C. D. WHEELER, manager of the advertising department of the Fort Wayne Electric Works of the General Electric Company, has been elected president of the Electro-Technic Club, Fort Wayne, Ind.

MR. J. C. SCHMIDTBAUER has been elected president of the Milwaukee Electrical League. Other officers are: First vice-president, Mr. Conrad F. Boos; second vice-president, Mr. Philip Polachek; treasurer, Mr. John C. Milne; secretary, Mr. H. C. Pond; assistant secretary, Mr. Oscar Werwarth.

OBITUARY.

MR. WOODBURY E. CORSON, city electrician of Haverhill, Mass., died May 6 of cerebral hemorrhage. He was born in Milton, N. H., in 1862 and early in life entered the employ of the Essex Electric and Power Company. Then he became electrician for the Boston Steam and Power Company, returning to Haverhill as chief engineer of the Haverhill Electric Company, where he remained 12 years, in 1905 becoming city electrician. Mr. Corson was a prominent lodge man. A widow, two daughters and a son survive.

MR. I. IRVING EDGERLY, superintendent of the construction department of the Lynn Gas and Electric Company, died in a private hospital at Lynn, Mass., May 13, following an operation for liver trouble. He was a native of Stafford, N. H., and was 55 years of age. He removed to Swampscott, Mass., in 1887, where he became engaged in construction work. He was twice elected superintendent of highways of that town, and was a member of the Water and Sewer Board. Mr. Edgerly was a member of the Masons, Odd Fellows, Red Men, Knights of Pythias and several clubs. He is survived by a widow, one son and a brother.

DATES AHEAD.

Missouri Public Utilities Association. Annual convention, Steamer *Quincy*, May 27-30. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

National District Heating Association. Annual convention, Hotel Sherman, Chicago, Ill., June 1-3. Secretary, D. L. Gaskill, Greenville, O.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

Minnesota Electrical Contractors' Association. Semi-annual meeting, Duluth, Minn., June 10. Secretary, G. M. Jones, 14 Seventh Street, N., Minneapolis, Minn.

Electrical Supply Jobbers' Association. Summer meeting, Hotel Statler, Detroit, Mich., June 15-17. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Association of Railway Telegraph Superintendents. Annual meeting, Rochester, N. Y., June 22-25. Secretary, P. W. Drew, 112 West Adams Street, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, Ames, Iowa, June 22-25. Secretary, F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Michigan Section, National Electric Light Association. Annual convention cruise, Steamer *Rochester*, June 26 to 30. Secretary, Herbert Silvester, 18 Washington Avenue, Detroit, Mich.

American Institute of Electrical Engineers. Annual convention, Deer Park, Md., June 29-July 2. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York, N. Y.

National Electrical Contractors Association of the United States. Fifteenth annual convention, San Francisco, Cal., July 21-24. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Statler, Detroit, Mich., September 8-11. Secretary, W. T. Snyder, McKeesport, Pa.

International Engineering Congress, San Francisco, Cal., September 20-25. Executive secretary, E. J. Dupuy, Foxcraft Building, San Francisco, Cal.

With the Electrical Manufacturers

The Shaw Insulator Company, 207 Market Street, Newark, N. J., Henry M. Shaw, president, will hereafter manufacture exclusively the Shaw lightning arresters. The company is designer, engineer and manufacturer of molded insulation and lightning protector equipment.

Kerr Turbine Company, Wellsville, N. Y., has issued bulletin No. 52 describing and illustrating its Economy steam-turbine-driven pumps for water supply, boiler feeding, fire service, circulating condenser water, circulating water in heating systems, draining mines, etc. A copy will be mailed on application to the company.

The Fort Wayne Electric Works, Fort Wayne, Ind., will give its annual excursion to its employees on June 26. The trip will be over the Lake Erie & Western and the Big Four, to Cincinnati, O., and it is expected that it will be the largest excursion ever handled from Fort Wayne. Arrangements are being made for the accommodation of 3,500 people.

Roth Brothers & Company, Adams and Loomis Streets, Chicago, Ill., have published bulletin No. 199, on direct-current motors for driving band saws. These machines, although used most commonly for this type of machinery, have also been found well adapted for driving cloth-cutting and other machines operating on soft materials. The motors are well inclosed and arranged, as a rule, for lateral mounting on the machine.

The American Conduit Company, East Chicago, Ind., has prepared a very interesting booklet describing and illustrating methods of manufacturing fiber conduit. The electrical man who at any time has occasion to use conduit for underground construction will find this treatise of particular value. One of the features of the booklet is a chapter on approximate construction costs. The booklet will be sent to those interested upon request.

The Brassart Fixture Company, 13-15 Laight Street, New York City, has been organized to manufacture a medium-priced line of electric lighting fixtures. N. W. Belmuth and Mr. Rosenberg, formerly of Shapiro & Aronson Company, are associated in the enterprise, and Henry Popkin, who

formerly traveled the middle west and western territory for that company, will also be connected with the firm.

The Globe Electric Company, Milwaukee, Wis., has issued catalog No. 2. This describes in detail, with the aid of many illustrations, the company's 30-volt direct-current electric plants with storage-battery auxiliary. These plants are designed particularly for country-house and farm lighting. They are made in several different sizes, some of which are of ample capacity to operate various motors and current-consuming devices besides the lighting system. Auxiliaries, electrical appliances and supplies for such plants are also illustrated and described in the catalog.

Appleton Electric Company, 212 and 214 North Jefferson Street, Chicago, Ill., has purchased from O. M. Pague the patent rights for Pagrip metal molding and fittings, as well as the dies, tools and special machinery for the manufacture of this new product. This type of molding and fittings were described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 24, 1915. The Appleton Electric Company has thus become the sole manufacturer of this molding.

Eck Dynamo & Motor Company, Belleville, N. J., has published bulletin No. 1000, giving a description of the company's new type D commutating pole motor. This bulletin describes in detail many advantageous features in these machines. In placing these motors on the market it was determined to incorporate in them all the best features of direct-current motor construction. Three features have received special attention. By using commutating poles sparkless commutation is obtainable at all loads without the necessity of shifting the brushes. By use of positive ventilation by internal fans and use of liberal air ducts the motors are kept cool and thus the danger of deterioration of the insulation due to high temperatures is reduced to a minimum. By the use of the double row self-alining ball bearings, bearing trouble is reduced to a minimum and the loss due to friction of ordinary bearings is almost entirely eliminated. Perfectly noisless operation is claimed for these motors, since they are so built as to be entirely free from magnetic hum. Radial brush-holders are used to hold the carbon brushes correctly for rotation in either direction without necessity of changing.

Record of Electrical Patents

Issued by the United States Patent Office, May 11, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,138,625. Series Transformer. G. Burnham, assignor to S. B. Condit, Jr., Brookline, Mass. Excessive secondary voltage prevented. (See cut.)

1,138,632. Electric Regulation. J. L. Creveling, assignor to Safety Car Heating & Lighting Co., New York, N. Y. Resistances in parallel and common operating means varying one through its range before affecting the other.

1,138,637. System of Electrical Distribution. H. P. Davis, and F. Conrad, assignors to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Resistance placed in supply section before overloaded distributing section is cut out, then resistance excluded.

1,138,638. Locomotive. J. LeC. Davis, assignor to Westinghouse Electric & Mfg. Co. Construction of frame and motor field.

1,138,646. Stylus-Positioning and Circuit-Controlling Means for Sound-Reproducing Machines. C. W. Ebeling, Wheeling, W. Va. Electrical means for entering needle in record groove.

1,138,647. Safety Speed-Control Apparatus for Motors. S. H. Eckmann and J. Wagner, assignors to Westinghouse Electric & Mfg. Co. Hoist motor driving load at several normal speeds has power cut off and brake applied upon load exceeding normal speed at any time.

1,138,652. Wireless Telegraphy. B. Graves, Thorntown, Ind. Oscillation detector has electrodes separated by molecularly active gas.

1,138,659. Resistance Device. S. E. Huenerfauth, Chicago, Ill. For electroplating tanks.

1,138,672. Dynamo-Electric Machine. B. G. Lamme, assignor to Westinghouse Electric & Mfg. Co. Laminated field magnet having compensating and auxiliary coils.

1,138,673. Switching Device. B. G. Lamme and J. L. McK. Yardley, assignors to Westinghouse Electric & Mfg. Co. For controlling a plurality of dynamo-electric machines mechanically associated and connected in series.

1,138,674. Process of Preparing Arc-Lamp Electrodes. G. M. Little and B. J. Gudge, assignors to Westinghouse Electric & Mfg. Co. Simultaneously bakes and rotates in draft of air.

1,138,676. Process of Manufacturing Insulating Material. W. J. Longmore, assignor to Westinghouse Electric & Mfg. Co. Sheets made from mica scales.

1,138,677. Electrically Operated Switch. W. O. Lum, assignor to Westinghouse Electric & Mfg. Co. Has electromagnet adapted for use with alternating current.

1,138,688. Self-Restoring Annunciator. A. C. Reid, assignor to Cracraft, Leich Electric Co., Genoa, Ill. Particular structure having releasing and restoring electromagnets.

1,138,689. Synchronizing System. B. P. Rowe, assignor to Westinghouse Electric & Mfg. Co. Throwing in controlled by synchronism and load.

1,138,690. Meter. A. B. Rypinski, assignor to Westinghouse Electric & Mfg. Co. A torsional spring normally out of engagement with the meter spindle may be engaged therewith.

1,138,691. Method of Producing Mica Insulation. J. R. Sanborn, assignor to Westinghouse Electric & Mfg. Co. Sheets made from mica flakes.

1,138,693. Trolley. W. Schaake, assignor to Westinghouse Electric & Mfg. Co. Arrangement of contacts on a pantograph frame.

1,138,698. Telephone. E. S. Stewart and C. D. Stewart, Ottawa, Ill. Repeater.

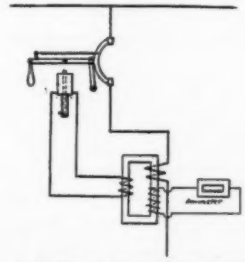
1,138,701. Overhead Electric-Line Construction. T. Varney, assignor to Westinghouse Electric & Mfg. Co. Steadying device for trolley conductors.

1,138,702. Electric-Line Support. T. Varney, assignor to Westinghouse Electric & Mfg. Co. Supporting insulator adjustable along an arc.

1,138,712. Non-Glaring Headlight. J. E. Wright, Bay City, Mich. Lamp before reflector at inner end of funnel-like hood having laterally flaring reflecting surface and downwardly flaring non-reflecting surface.

1,138,723. Trolley-Wheel Mount. G. H. Bolus, assignor to the Ohio Brass Co., Mansfield, O. Means for rotating the harp about a vertical axis.

1,138,733. Electrical Heating Unit. L. G. Copeman, assignor to Copeman Electric Stove Co., Flint, Mich. Resistor sections



No. 1,138,625.—Series Transformer.

wound in spiral groove in heat-distributing and insulating body and secured therein by overhanging lugs.

1,138,734. Automatic Telephone Responding Apparatus. E. J. Cressey, Wichita, Kans. Telephone combined with phonograph.

1,138,739. Composite Electrical System. R. M. Eaton, assignor to Garford Mfg. Co., Elyria, O. Combined police and telephone system.

1,138,744. Device for Automatically Controlling Moving-Picture Machines. B. Garros, assignor to C. E. Allinger, C. A. Strelinger, C. T. Bush and M. E. Jones, Detroit, Mich. Electric light and motor controlled by the film.

1,138,746. Brush or Collector for Electrical Machines. E. Gindre, assignor to Societe Anonyme le Carbone, Levallois-Perret, Paris, France. Cap connecting pigtail to brush.

1,138,748. Track Relay for Signal System. G. E. Gray, assignor to Automatic Train Control & Signal Co., Pittsburgh, Pa. Has two electromagnets, one of which polarizes and the other actuates the armature.

1,138,752. Key-Operated Rotary Switch. M. Guett, assignor to the Hart & Hegeman Mfg. Co., Hartford, Conn. Flush locking wall switch.

1,138,754. Circuit-Interrupter. F. W. Harris, assignor to Westinghouse Electric & Mfg. Co. Relates to the tripping means.

1,138,761. Electrolytic Interrupter. J. R. Kelley, Covington, Ky. Construction and mounting of the electrodes.

1,138,763. Electric Switch. C. J. Klein, assignor to the Cutler-Hammer Mfg. Co., Milwaukee, Wis. Feed-through switch.

1,138,773. Steady Brace for Trolley Lines. G. A. Mead and W. H. Kempton, assignors to the Ohio Brass Co. Separate from the suspension and flexibly connected with trolley wire.

1,138,785 and 1,138,786. Demand Indicator. W. E. Porter, assignor to General Electric Co., Schenectady, N. Y. A record sheet is returned to initial position at intervals and a record mark imprinted at end of each interval.

1,138,787. Demand Apparatus. W. E. Porter, assignor to General Electric Co. Gearing for carrying out operations similar to above.

1,138,797. Spark Plug. A. Schmidt, assignor to Champion Ignition Co., Flint, Mich. Sheet-metal electrode has heat-conducting and retaining connection in slot in end of plug.

1,138,800. Circuit-Breaker. W. M. Scott, Berwyn, Pa. Sucker elements are connected with the tripping device and means provided for preventing lost motion between them.

1,138,804. Device for Perforating Paper. P. J. Simmen, Indianapolis, Ind. Punch actuated by electromagnet

1,138,808. Circuit-Controller. L. L. Tatum, assignor to Cutler-Hammer Mfg. Co. Movable contact acts as abutment contact at beginning of series of fixed contacts and sliding contact thereafter in both directions of movement.

1,138,809. Signaling Device for Motor Vehicles. J. A. Thompson, Rosebank, N. Y. Direction signs on carrier lighted by lamp show through aperature in casing.

1,138,811. Spark Plug. J. Triska, Omaha, Nebr. Sliding carbon-removing sleeve.

1,138,827. Third-Rail System. P. H. Z. Mallen, Chicago Heights, Ill. Rail has sections successively energized by passage of contact shoe.

1,138,830. Printing-Telegraph Receiver. C. Ashley, assignor to General Engineering & Construction Co., Toronto, Canada. Common electromagnet withdraws pens from paper and individual magnets force them against it.

1,138,832. Writing Machine. O. G. Bamberg and E. Weinhold, Laibach, Austria-Hungary. Change-over connections between two type machines to transmit in cipher and to decipher.

1,138,834. Direction-Indicator for Vehicles. W. W. Bell, Alameda, Cal. Electromagnetically operated and controlled by the steering and braking mechanism.

1,138,836. Lighting-Fixture Apparatus. N. B. Bishop, Los Angeles, Cal. Shade-

supporting attachment for electric light sockets.

1,138,841. Electric Sadiron. W. A. Braun, assignor to Dover Mfg. Co., Canal Dover, O. Automatically controlled by an adjustable thermostat.

1,138,848. Bracket for Locomotive Headlights. G. W. Dake, assignor to Pyle-National Electric Headlight Co., Chicago, Ill. Adjustable lamp support.

1,138,853. Contactor. F. L. Eager, Waterbury, Conn. Trolley-actuated.

1,138,854. Circulation-Control System. E. F. Edgecombe, Jr., Marion, Ind. Hot-air-circulating blower electromagnetically controlled by thermostat at furnace and location to be heated.

1,138,857. Combined Switch and Fuse. R. Elsman, San Francisco, and C. Dallerup, San Rafael, Cal. For mounting at pole top. (See cut.)

1,138,870. Glass-Drawing Apparatus. H. F. Hitner, assignor to Pittsburg Plate Glass Co., Pittsburgh, Pa. Electrically driven and position of parts indicated by electric signal.

1,138,874. Electric Switch. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Foot switch for automobile electric starter.

1,138,879. Trunking System for Telephone Exchanges. F. R. McBerty, assignor to Western Electric Co., New York, N. Y. Automatic system.

1,138,884. Attachment for Edge-Setting Machines. R. J. B. Monchamp, Manchester, N. H. Has heating coils.

1,138,889. Magnetic Separator. D. L. Rand, Ayr, N. D. A series of magnets arranged in a grain chute.

1,138,912. Dynamo-Electric Machine. M. E. Thompson, Ridgway, Pa. Laminated pole piece for alternator.

1,138,921. Process of Recovering Metals by Electrolysis. L. Addicks, Douglas, Ariz. Electrolytic reduction of metals in presence of a substance having solvent action upon the deposited metal.

1,138,945. Perforating Apparatus for Making Register Bands. E. Ehrhardt, assignor to Siemens & Halske A-G., Berlin, Germany. Electrically operated.

1,138,958. Printing Telegraph. O. L. Kleber, Pittsburgh, Pa. Typewheel operated by pulsations of current.

1,138,959. Telephone Transmitter. D. Koenig, assignor to Western Electric Co. Granular chamber having heat-conducting walls.

1,138,965. Trolley Mechanism. G. E. Lynch, assignor to Jeffrey Mfg. Co., Columbus, O. Arrangement of arms and spring for forcing the trolley against the wire.

1,138,979. Electrically Driven Clock. T. Rushton London, England. Relates to the winding arrangement.

1,138,984. Lamp. R. C. Shaal, assignor to Safety Car Heating & Lighting Co. For vehicles; has light-refracting bottom throwing light downwardly and rearwardly.

1,138,988. Visual-Signal Station. A. L. Sohm, assignor to Sohm Electric Signal & Recording Co., Spokane, Wash. Visual indication of proper closing of circuit by insertion of plug in spring jack.

1,138,989. Time Clock Mechanism. A. L. Sohm, assignor to Sohm Electric Signal & Recording Co.. Record controlled by contacts engaging with the hands.

1,138,990. Electrical Circuit-Changing Mechanism. A. L. Sohm, assignor to Sohm Electric Signal & Recording Co. Two sets of contacts having interconnected electromagnetically actuated wipers.

1,138,991. Electrical Apparatus and Circuit. A. L. Sohm, assignor to Sohm Electric Signal & Recording Co. Electromagnet actuates contacts and is controlled by master clock.

1,139,001. Electrical Water-Heater. S. LeF. Varvel, Melbourne, Victoria, Australia. Fluid circulates about chamber inclosing helically wound high-resistance wire and filled with heat-conducting material.

1,139,005. Magnetic Clutch. A. W. Whitcomb, Worcester, Mass. Face of each member has a concentric series of magnetizable surfaces with non-magnetic material between them.

1,139,022. Photographic Camera. W. F. Folmer, assignor to Eastman Kodak Co., Rochester, N. Y. Has light chamber and object-illuminating lamp and battery.

1,139,047. Drawbridge Circuit-Controller. F. Marsellis, Berkeley, Cal. Adjustable cooperating contacts on the bridge and abutment, respectively.

1,139,066. Pneumatic Time-Switch. G. H. Parsons, assignor to T. LaM. Couch, Stamford, Conn. Operated by a bellows.

1,139,069. Electric Vulcanizer. C. A. Pfanstiehl, North Chicago, Ill. Hand device in which a plier-like arrangement forces electrically heated member and pressure plate together.

1,139,074. Means for Automatically Closing Vault Doors. F. W. Rodler, assignor to Victor Safe & Lock Co., Norwood, O. Arrangement and gearing of motor.

1,139,076. Resistance for Electric Heaters. E. A. Rutenber, Logansport, Ind. Resistance conductor laced through apertures in plate of insulation.

1,139,078. Speed-Changing Mechanism. H. G. C. Schwarze, Detroit, Mich. Gear shifted by electromagnet.

1,139,087. Electric Door Latch. T. S. Torresson, New York, N. Y. Latch controls push-button in alarm circuit.

1,139,121. Electrical Ignition System for Internal-Combustion Engines. G. Honold, assignor to firm of Robert Bosch, Stuttgart, Germany. Starting and service magnetos., former operated during cranking.

1,139,127. Composite Electric System. A. D. T. Libby, assignor to Garford Mfg. Co., Elyria, O. Combined police and telephone system.

1,139,138. Device for Relieving the Pull on the Rope for Coupling Devices for Electric Conductors. W. Schmidt, Frankfort-on-the-Main, Germany. Arc lamp connection with means holding closed after pulled together.

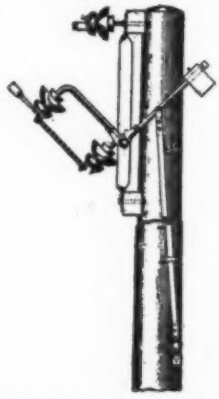
1,139,141 and 1,139,142. Locking Clip. L. Steinberger, Brooklyn, N. Y. For securing trolley wire to spanner hanger.

1,139,152. Burglar-Alarm Lock. J. Baltes, New York, N. Y. Circuit controlled by sliding bolt with provision for operating without sounding alarm.

1,139,155. Mail-Box Signal. A. R. Bennett, Knoxville, Tenn. Circuit controlled by latch.

1,139,158. Vibration-Absorbing Support. F. S. Boerries, Paris, France. Spring-suspended platform for motor.

1,139,169. Demand Apparatus. J. T. Dempser, assignor to General Electric Co.



No. 1,138,857.—Pole-Top Switch and Fuse.

Two electromagnetic means controlled by meter shaft, one for driving forward and other for returning to initial position.

1,139,177. Fireman's Helmet. J. M. Ganzer, Poughkeepsie, N. Y. Includes a telephone receiver and transmitter.

1,139,185. Adjusting Means for Thermostats and the Like. P. F. Johnson, Milwaukee, Wis. Indicator shows position of adjusting member.

1,139,201. Direct-Current Dynamo Machine. W. Tuyken, assignor to Fried. Krupp A-G., Essen-on-the-Ruhr, Germany. Permanent magnetism destroyed by alternating-current winding on field.

1,139,203. Direct-Current Machine. C. W. Girvin, assignor to Girvin Electrical Development Co., Honolulu, Hawaii. Open-circuit armature coils connected in series and currents rectified by a commutator.

1,139,210. Electric Engine-Starter. M. P. Mitchell, Eaton, O. Motor on sleeve on engine shaft, and clutch between sleeve and shaft.

1,139,213. Negative-Pole Plate for Alkaline Storage Batteries. W. Morrison, Des Moines, Iowa. Insoluble zinc-titanum compound formed by mixture of solutions of a zinc salt and soluble titanate.

1,139,214. Electrolyte for Secondary Batteries. W. Morrison. Acid solution of titanium compound.

1,139,222. Illuminated Sign. F. N. Poulallion, Des Moines, Iowa. Cam-operated covers intermittently obscure the sign plates.

1,139,226. Radiotelegraphy. E. Raymond-Barker, assignor to Amalgamated Radio-Telegraph Co., London, England. Employs shunted electric arcs.

1,139,245. Guard for the Booths of Picture-Projecting Machines. A. Werner and R. Denniss, San Francisco, Cal. Fuses holding shutters open blow when circuit is closed by thermostat near film.

1,139,251. Automatic Time-Check for Oil Presses and Other Machines. T. Bell, Tyler, Tex. Electromagnetically controlled marker records when machine is idle.

1,139,255. Dual Ignition System. A. P. Brush, Detroit, Mich. Provides for use of either magneto or battery in starting.

1,139,258. Signal Box. T. H. S. Cone, Boundbrook, N. J. Operating lever external to box and held in normal position by frangible rod.

1,139,259. Manufacture of Electrotype Plates. C. P. Cottrell, assignor to C. B. Cottrell & Sons Co., New York, N. Y. Way of holding while forming gradations on front and casting on backing-up metal.

1,139,277. Reflected-Light-Diminishing Apparatus. J. F. Harrell, Indianapolis, Ind. Relative positions of focusing reflector and lamp in automobile head light adjustable from seat.

1,139,278. Electric Switch. G. H. Hart, West Hartford, Conn. Push-button switch with spring and cam for quick movement of blade.

1,139,291. Coating with Fusible Material. C. F. Jenkins, Washington, D. C. Fuses material by passing electric current and then projecting small particles against object at high velocity.

1,139,294. System of Distribution. J. L. Johnson, assignor to Allis-Chalmers Mfg. Co. Synchronous speed of motor varied by varying relative frequencies of alternating currents applied to rotor and stator according to load.

1,139,295. Circuit-Closer for Electric Lighted Levels or Plumbs. A. R. Jones Bangor, Me. Particular form of switch arranged in recess in the level body.

1,139,300. Electric Riveting Apparatus. F. P. Kobert, New Haven, Conn. Brings a plunger and electrode for heating current alternatively into operation.

1,139,305. Composite Insulating Material. H. B. MacFarland and R. J. Shoemaker; said Shoemaker assignor to said MacFarland, Chicago, Ill. Integrally united strata of felted cellulose fibers and hydro-cellulose.

1,139,347. Electromagnetic Device for Notifying and Recording the Passing of Signals at Danger. H. Cousin, Paris, France. Record is made when signal on car is operated by an obstacle along the way.

1,139,374. Watch Case and Movement Protector. E. A. Roney, Goldfield, Nev. Insulating cover.

1,139,389. Method of Operating an Electrolytic Cell. E. E. Werner, Indianapolis, Ind. Electrolytically generating chlorine from saline solution.

1,139,390. Manufacture of Plated Flat Ware. A. Wilzin, St. Ouen, France. Blank is polished, plated, again polished and then stamped or embossed.

1,139,410. Apparatus for Detinning Tin Scrap, Boxes or the Like. H. Goldschmidt, assignor to Goldschmidt Detinning Co., New York, N. Y. Electrodes movable in and out of bath and anodes carry baskets holding articles to be detinned.

1,139,413. Apparatus for Transmitting Sounds by Means of Hertzian Waves. W. Harrison, New York, N. Y. Sounds control ultra-violet light thrown on current in gap.

1,139,466. Demand Apparatus. L. T. Robinson and J. T. Dempster, assignors to General Electric Co. Electric meter and means for recording the times in which predetermined equal quantities of energy are metered.

Patents Expired.

The following United States electrical patents expired on May 17, 1915:

604,032. Electrical Safe-Protection System. I. Freed, Harrisburg, Pa.

604,055. Electromagnet Having Rotating Fields. W. Langdon-Davies, London, England.

604,081 to 604,085. Electric Lighting Apparatus for Railway Cars. W. F. Richards, Buffalo, N. Y.

604,094. Telephone-Switchboard Plug. J. Taylor, Heathercliffe, Helsby, England.

604,098. Rail Conducts for Electric Systems. L. E. Walkins, Springfield, Mass.

604,101. Electric Lighting Apparatus for Cars. E. Wilhelm and W. F. Richards, Buffalo, N. Y.

604,128. Electrical Apparatus for Operating Elevator Doors. H. R. Smith, Chicago, Ill.

604,137. Apparatus for Electrically Working Metals. J. D. Bishop, New York, N. Y.

604,157. Circuit-Closer. W. D. Kennedy, Easton, Pa.

604,196. Trolley for Electric Railways. S. H. Short, Cleveland, O.

604,219. Electric Arc Lamp. F. W. Steinacker and E. F. Cowley, Cleveland, O.

604,258. Apparatus for Joining Telegraph Cables. H. Menier, Paris, France.